Following a detailed site inspection, and based on the information provided by site owners that rejected any suggestion that the site had been used in the manner alleged, it was considered there was no justification for any additional studies.

From the investigations carried out by the Council at this site, there is no evidence to support the claims made concerning inappropriate burial or disposal of agrichemical wastes at this site. There is no evidence of site contamination, or of an environmental risk.

F IWD-1 South eastern corner of property

A site identified as an alleged disposal site by former staff.

A GPR survey was conducted at this site. The detailed record is presented in Appendix IV. The survey showed normal soil strata data across all of the site, and showed no evidence of previous site excavations, a drum dumpsite, or other buried refuse.

Samples of groundwater were collected from two groundwater monitoring bores within and on opposite sides of the area, maintained on the property (4062, 4065). They were analysed for acid herbicides and for 2,3,7,8 TCDD. The results are presented in full in Appendix IX. The results are as follows:-no acid herbicides were detected in Bore 21, to the west of this area, or in Bore 1, to the east. The limits of detection were 0.1 parts per billion. No 2,3,7,8 TCDD was detected in either bore. The limit of detection was 3-9 parts per quadrillion.

These results are at or below background levels of these chemicals. They show no evidence of burial or disposal of agrichemical wastes at this site.

From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical wastes at this site. There is no evidence of site contamination, or of an environmental risk.

The site is routinely monitored by the Council as part of an ongoing compliance monitoring programme.

G Marfell Park

A former authorised municipal landfill that received IWD liquid wastes during sewerage system maintenance.

A GPR survey was not conducted at this site. The site is a known previous municipal refuse disposal site.

Samples of leachate/stormwater from the park, soil from a point of seepage from the corner of Grenville and Endeavour Streets, sediment from beneath the point of discharge of leachate and stormwater into the Mangatuku Stream, and a sample from the stream were collected at this site (4000, 4001, 4002, 4057). They were analysed for acid herbicides and for organochlorine pesticides. The results are presented in full in Appendix IX. The results are as follows:- no acid herbicides were detected in the seepage, at a limit of detection of 0.1 parts per million, or organochlorine pesticides, at a detection limit of 0.1-0.3 ppm.

No organochlorine pesticides were detected in the leachate flowing from the drain. The limit of detection was 1-2 parts per billion. No acid herbicides, other than 2,4-D at a level of 3 parts per billion, were detected in the leachate flowing from the drain. The limit of detection was 1 ppb.

The New Plymouth District Council had collected a sample of the discharge from the park just prior to the present study being undertaken, and had had a complete dioxin analysis undertaken. The full results are presented in Appendix IX (referred to as Cook Street). No 2,3,7,8 TCDD was detected. The limit of detection was 2 parts per quadrillion. Other dioxins (non 2,3,7,8 TCDD) were detected, at 9.3 ppq. This indicates a source or sources other than agrichemical wastes.

These results are at or below background levels of these chemicals.

From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical-contaminated wastes at this site. There is no evidence of contamination of the site by such wastes, or of an environmental risk.

The site is routinely monitored by the Council as part of an ongoing compliance monitoring programme.

H Ngamotu Domain

A former authorised municipal landfill that received IWD liquid wastes during sewerage system maintenance.

A GPR survey was not conducted at this site. It is a known landfill. The issue of concern related to liquid wastes.

Samples of streambed sediment and discharges were collected at this site (4004, 4022, 4023, 4024). They were analysed for acid herbicides and organochlorine pesticides (discharges). The results are presented in full in Appendix IX. The results are as follows:- no acid herbicides were detected in the discharges. The limit of detection was 0.1 parts per billion. No organochlorine pesticides were detected in the discharges, at a limit of detection of 0.1 parts per million.

These results are at or below background levels of these chemicals.

From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical-contaminated wastes at this site. There is no evidence of contamination of the site by such wastes, or of an environmental risk.

I 7A Squire Place

A site where a stormwater culvert discharges, above Ngamotu Domain (site H). An alleged contaminated soil disposal site.

A GPR survey was not conducted at this site.

A sample of sediment from below the discharge was collected at this site (4003). It was analysed for 2,3,7,8 TCDD. The results are presented in full in Appendix IX. The results are as follows:- no 2,3,7,8 TCDD was detected in the sediment sample. The limit of detection was 10 parts per trillion. This limit is far below the current residential guideline

for NZ of 1500 ppt. There is no NZ guideline for recreational areas, which would be higher than for a residential area.
From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical wastes at this site. There is no evidence of site contamination, or of an environmental risk.

J Belt Road

A former unauthorised discharge area that received liquid wastes from the Paritutu area during sewerage system maintenance.

A GPR survey was not conducted at this site, as the issue was disposal of liquid wastes onto the ground.

Samples of surface soil were collected at this site (4026, 4043). The second sample was collected following clarification of the location of the alleged disposal site by DIAG/DIN. It was analysed for 2,3,7,8 TCDD. The results are presented in full in Appendix IX. The results are as follows:-no 2,3,7,8 TCDD was detected in the surface soil sample. The limit of detection was at a level of less than 9 parts per trillion. The limit of detection is far below the current residential guideline for New Zealand of 1500 ppt. There is no New Zealand guideline for recreational areas, which would be higher than for a residential area.

The marine ecology on the foreshore in the vicinity of the site was surveyed. Samples of biota were collected for analysis for 2,3,7,8 TCDD. The results are presented in Appendix VI.

The marine ecology was found to be in a healthy state, and the levels of 2,3,7,8 TCDD similar to those found by the Ministry for the Environment in its survey of background levels of dioxins in marine biota around New Zealand.

From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical-contaminated wastes at this site. There is no evidence of site contamination, or of an environmental risk, either on the site or in the adjoining marine environment.

K Victoria Road, Oakura

A farmlet that received 200 litre drums of offspec chemical for weed control.

A GPR survey was not conducted at this site, as the issue was discharge of liquid agrichemicals onto land.

A detailed site inspection by Council staff found no reason to conduct further investigations. From the investigations carried out by the Council at this site, while there was unorthodox weed control operations, there is no evidence of inappropriate burial of agrichemical wastes at this site.

L 23C Tahurangi Place

An alleged stormwater discharge point off the IWD site prior to subdivision.

A GPR survey was not conducted at this site, as the issue in hand was that of stormwater discharge, not drum disposal.

Samples of surface soil from the rear of the property and from beneath the house were collected and analysed for 2,3,7,8 TCDD and for acid herbicides (4053, 4054). The results are presented in full in Appendix IX. The results are as follows:-no acid herbicides were detected in either of the samples. The limits of detection were 0.1 parts per million. No 2,3,7,8 TCDD was detected in either of the two soil samples. The limit of detection was 4-6 parts per trillion. This detection limit is below the New Zealand agricultural guideline, of 10 ppt, and far below the residential guideline, of 1500 ppt.

These results are at or below background levels of these chemicals.

From the investigations carried out by the Council at this site, there is no evidence of inappropriate disposal of agrichemical wastes at this site. There is no evidence of site contamination, or of an environmental risk.

M Beach Road-1

An alleged dumping site of 200 litre drums. This site may have been confused with the Ngahoro Site (site Z), where drums were dumped and have since been removed.

A GPR survey was conducted at this site. The detailed record is presented in Appendix IV. The survey showed normal data across the majority of the site. In one part of the site the GPR data showed anomalies consistent with pipes, at a considerable depth (4 metres). The data showed no evidence of a drum dumpsite or other buried refuse.

A sample of sediment from a swampy area was collected at this site (4009, 4010). The sediment sample was analysed for 2,3,7,8 TCDD. The results are presented in full in Appendix IX. The results are as follows:- 2,3,7,8 TCDD was detected at 2.0 parts per trillion.

This result is well below the NZ agricultural soil standard of 10 ppt..

From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical wastes at this site. There is no evidence of site contamination, or of an environmental risk.

N Waireka rehabilitated dumpsite

The IWD dumpsite rehabilitated during the mid 1980s..

A GPR survey was not conducted at this site. The site was comprehensively examined and remediated during the early 1980s

Samples of whelks were collected and analysed for the presence of acid herbicides and for 2,3,7,8 TCDD. The results are presented in full in Appendix IX. No acid herbicides were detected, at a detection limit of 0.1 parts per million.

The marine ecology in the vicinity of the outfall was surveyed. Samples of biota were collected for analysis for 2,3,7,8 TCDD. The results are presented in Appendix VI. The marine ecology was found to be in a healthy state, and the levels of 2,3,7,8 TCDD similar to those found by the Ministry for the Environment in its survey of background levels of dioxins in marine biota around New Zealand.

A sample of the leachate collected in a rock pool beneath the seepage discharge area was collected and analysed for 2,3,7,8 TCDD. The results are presented in full in Appendix IX. No 2,3,7,8 TCDD was detected. The limit of detection was 8 parts per quadrillion.

From the investigations carried out by the Council at this site, there is no evidence of an environmental risk arising from the low level continuing discharge of groundwater and leachate at this site.

O Pioneer Road

Another identification of the Ngamotu Domain site (see site H).

P 26A Rangitake Drive

This section was in the path of a small tributary of the Herekawe Stream which carried stormwater from the IWD site prior to subdivision and was also an alleged casual dumpsite.

A GPR survey was conducted at this site. The detailed record is presented in Appendix IV. The survey showed normal data across most of the site. Anomalous data in one area indicated the possibility of a few buried objects, while data from another area indicated buried refuse or similar small objects. The data showed no evidence of a drum dumpsite. The section is known to have been filled prior to subdivision.

Samples of soil and sediment from beneath seep patches were collected at this site (4044, 4045, 4046, 4047). They were analysed for acid herbicides and for organochlorine pesticides. The results are presented in full in Appendix IX. The results are as follows:-no organochlorine pesticides were detected in sediments taken on two different parts of the site, nor in sediments from the bed of the Herekawe Stream approximately 30 metres downstream of the property. The limits of detection were 0.1-0.3 parts per million. No acid herbicides were detected in any sample, at a limit of detection of 0.1 ppm.

These results are at or below background levels of these chemicals.

From the investigations carried out by the Council at this site, there is no evidence of the use of this site as a drum dumpsite or for the inappropriate burial or disposal of agrichemical wastes. Council staff will liase with the site owner if any further work to determine the nature of the objects shown in the GPR data is desired. There is no evidence of site contamination, or of an environmental risk.

Q Rifle Range Road/Bewley Road

A former authorised municipal landfill alleged to have received IWD wastes.

A GPR survey was not conducted at this site, as it is a known past refuse disposal site covering a wide area.

Samples of leachate seepage, groundwater, and sediments were collected at several points across this site (4035, 4037, 4038, 4039, 4040, 4041, 4042). These included sampling all observed seepage points. They were analysed for acid herbicides and for organochlorine pesticides. The results are presented in full in Appendix IX. The results are as follows:-no organochlorine pesticides were detected in the groundwater sample. The limits of detection were 1-2 parts per billion. No acid herbicides were detected in the same sample. The limit of detection was 0.1 ppb. No organochlorine pesticides were

detected in the sediment samples (limit of detection 0.1-0.5 parts per million). No acid herbicides were discovered in the sediment samples. The limits of detection were 0.1 parts per million.

These results are at or below background levels of these chemicals.

From the investigations carried out by the Council at this site, there is no evidence of the use of this site as a drum dumpsite, or of inappropriate burial or disposal of agrichemical wastes at this site. There is no evidence of contamination of the site by agrichemicals, or of an environmental risk.

The site is routinely monitored by the Council as part of an ongoing compliance monitoring programme.

R Beach Road-2

A dumping site of 200 litre drums that have since been removed.

A GPR survey was conducted at this site. The area to be studied was pinpointed by the nature of the allegations. The detailed record is presented in Appendix IV. The survey showed normal data across all of the site. The data showed no evidence of buried drums or other buried refuse. The site is flat, and has been recontoured. There was no sign of discharges to the environment from the site.

From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical wastes at this site since the removal of known wastes and remediation. There is no evidence of site contamination, or of an environmental risk.

S not assigned- combined with Site I

T Colson Road landfill

Current municipal landfill for New Plymouth alleged to have received agrichemical wastes.

The landfill is routinely inspected and sampled by the Council as part of an ongoing compliance monitoring programme.

The New Plymouth District Council had collected a sample of the leachate discharge from the landfill just prior to the present study being undertaken, and had had a complete dioxin analysis undertaken. The full results are presented in Appendix IX. No 2,3,7,8 TCDD was detected. The limit of detection was 2 parts per quadrillion. No other dioxin congeners were detected. The limits of detection were 1-10 ppq.

From the routine ongoing monitoring carried out by the Council at this site, there is no evidence of the use of the site as a drum dumpsite, or of the inappropriate burial or disposal of agrichemical wastes at this site. There is no evidence of contamination of the site by agrichemicals, or of an environmental risk.

U IWD-2 South west area of property

A site identified as an alleged storage site for wastes, by former staff.

A GPR survey was conducted at this site. The detailed record is presented in Appendix IV. The survey showed normal soil strata data across the site, together with a significant underlying rock formation. The formation was already known from previous site studies. The data showed no evidence of previous site excavations, a drum dumpsite, or other buried refuse.

Samples of groundwater were collected from two groundwater monitoring bores, one at each end of and within this site (4063, 4068). The results are presented in full in Appendix IX. The results were as follows:-of the eleven acid herbicides analysed for, no acid herbicides were detected in Bore 43, to the east, except for picloram at a level of 0.1 parts per billion. No acid herbicides were detected in Bore 6, to the northwest, except for picloram at a level of 16 parts per billion. A repeat analysis of the sample from Bore 6 gave a result of 9.1 parts per billion.

There is no NZ Drinking Water Standard for picloram. However, the level detected in the groundwater is comparable with the NZ Drinking Water standards for various other acid herbicides (2,4-D 30 ppb, 2,4 DB 100 ppb, MCPA 2 ppb, mecoprop 10 ppb, dichlorprop 100 ppb, 2,4,5-T 10 ppb). The direction of flow is towards the northwest. Sampling of cliff face seeps at Site Zi, downflow of this site, did not detect any acid herbicides except for picloram at a level of 0.2 ppb. Given this result, and the processes of natural attenuation and degradation, it is considered that there are no grounds for environmental concern for picloram at this level.

No 2,3,7,8 TCDD was detected in either bore. The limit of detection was 2-3 parts per quadrillion.

Other than for picloram, these results are at or below normal background levels of these chemicals.

From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial of agrichemical wastes at this site. There is no evidence of an environmental risk.

The site is routinely monitored by Council staff, as part of an ongoing compliance monitoring programme

V Centennial-2

The former stormwater discharge point to the Tasman Sea from the office block area of IWD.

A GPR survey was not conducted at this site.

Samples of the discharge from the pipe, and sediment beneath the discharge, were collected at this site (4033,4034). They were analysed for acid herbicides and for organochlorine pesticides. The results are presented in full in Appendix IX. The results are as follows:-no organochlorine pesticides were detected in the discharge, nor in the sediments from beneath the flow. The limits of detection were 0.01-0.2 parts per billion for the discharge, and 0.1-0.5 parts per million for the sediment. No acid herbicides were detected in the discharge except for 2,4,5-T at a level of 0.4 parts per billion. The limit of detection was 0.1 ppb. No acid herbicides were detected in the sediments. The limit of detection was 0.1 parts per million.

Except for the 2,4,5-T result (which is well below the NZ drinking water standard of 10 ppt), these results are at or below background levels of these chemicals.

The marine ecology in the vicinity of the outfall was surveyed. Samples of biota were collected for analysis for 2,3,7,8 TCDD. The results are presented in Appendix VI.

The marine ecology was found to be in a healthy state. The levels of 2,3,7,8 TCDD found in the biota were slightly elevated above those found by the Ministry for the Environment in its survey of background levels of dioxins in marine biota around NZ. However, the levels were similar to those found in seafood in the Ministry's study of dioxin intake in New Zealand diets.

From the investigations carried out by the Council at this site, there is no evidence of inappropriate discharge of agrichemical wastes at this site. There is no evidence of an environmental risk.

W Herekawe Stream

The current stormwater discharge point from Dow AgroSciences. It is routinely monitored by the Council. Additional investigations were conducted as part of this study.

A GPR survey was not conducted at this site.

A sample of the discharge from the pipe was collected at this site. It was analysed for acid herbicides. The results are presented in full in Appendix IX. The results are as follows:-no acid herbicides were detected in the sample. The limits of detection were 0.1 parts per million.

These results are at or below background levels of these chemicals, and validate data routinely supplied by the Company to the Council, in addition to the Council's own test results on other occasions.

The marine ecology in the vicinity of the stream mouth was surveyed. The results are presented in Appendix VI. The marine ecology was found to be in a healthy state.

Additional information on this site is reported annually by the Council in its compliance monitoring programme report for the Herekawe catchment.

From the investigations carried out by the Council at this site, there is no evidence of any effects arising from inappropriate burial or disposal of agrichemical wastes at this site. There is no evidence of contamination, or of an environmental risk.

X Roto Street

An alleged dumpsite on the former plant nursery site.

A GPR survey was conducted at this site. The detailed record is presented in Appendix IV. The survey showed that the majority of the site consists of fill and debris material. The data showed no evidence of a drum dumpsite. The section is known to have been filled prior to subdivision.

Samples of soil (two areas), streambed sediment, seepage, and stream flow were collected at this site (4016, 4017, 4018, 4019, 4020, 4021). They were analysed for acid

herbicides and organochlorine pesticides (seeps). The results are presented in full in Appendix IX. The results are as follows:-no organochlorine pesticides were detected in the seep. The limits of detection were 0.01-0.2 parts per billion. No acid herbicides were detected in the seep. The limits of detection were 0.1 ppb.

These results are at or below background levels of these chemicals.

From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial of drums or disposal of agrichemical wastes at this site. There is no evidence of contamination of the seep, or of an environmental risk.

Y not assigned- combined with Site Q

Z Ngahoro

A known dumping site of 200 litre drums, that was rehabilitated in the 1980s.

A GPR survey was conducted at this site. The detailed record is presented in Appendix IV. The survey showed normal data across the top part of the site, and an anomalous area that is consistent with a previous excavation. This corresponds to the known use of this site for a drum disposal area in the 1970s and early 1980s, as described in Section 3 of this report. The data showed no evidence of a current drum dumpsite or other buried refuse.

Samples of soil and sediment from two swampy areas, to the northwest and southwest, were collected at this site. They were analysed for 2,3,7,8 TCDD. The results are presented in full in Appendix IX. The results are as follows:-2,3,7,8 TCDD was detected at a concentration of 330 parts per trillion in the northwest sample. This result is consistent with the known previous use of this site for disposal of agrichemical manufacturing wastes in the 1970s and early 1980s. The area of contamination is confined.

From the investigations carried out by the Council at this site, there is no new evidence of inappropriate disposal of agrichemical wastes at this site, other than that already known and remediated. There is no evidence of a significant environmental risk.

Za 60 Marama Crescent

An alleged casual dumpsite.

A GPR survey was conducted at this site. The detailed record is presented in Appendix IV. The survey showed in situ soil strata data across all of the site that was surveyed. There is a recent open excavation on the site.

The data showed no evidence of previous site excavations, a drum dumpsite, or other buried refuse.

From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical wastes at this site.

Zb Buller Street

The site of the original Ivon Watkins Limited.

This site has been previously investigated by the Council, including soil sampling and analysis. DDT at levels from less than 0.01 up to 1.3 parts per million were detected in soil. No 2,4,5-T was detected, and 2,4 D was detected in one soil sample only, at 0.8 ppm. No DDT or acid herbicide was detected in a sample of stormwater.

A GPR survey was not conducted at this site.

Samples of marine biota were collected for analysis for 2,3,7,8 TCDD from the vicinity of the old Elliot Street sewerage outfall, which would have been in use at the time this site was occupied by IWD. The marine ecology in the vicinity of the outfall was surveyed. These results are presented in the report on Site Zd below.

These results are marginally above background levels of these chemicals.

From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical wastes at this site. There is no evidence of contamination above recognised guidelines, or of an environmental risk.

Zc Tarahua Road

The site of a former Ivon Watkins Limited warehouse.

Following a detailed site inspection and discussion with the current owner, no further investigations were considered justified or were undertaken. The site is effectively capped by buildings and paved areas, such that there is no risk pathway even if contamination did exist.

Zd Tasman Sea - old Elliot Street outfall

The outfall off Elliot Street that included stormwater discharge from Buller Street.

The marine ecology in the vicinity of the outfall was surveyed. Samples of biota were collected for analysis for 2,3,7,8 TCDD. The results are presented in Appendix VI.

The marine ecology was found to be in a healthy state. The levels of 2,3,7,8 TCDD were slightly elevated above those at the control sites for this study and those found by the Ministry for the Environment in its survey of background levels of dioxins in marine biota around New Zealand. This is to be expected for a municipal sewage discharge, and the level detected is typical of those reported elsewhere.

From the investigations carried out by the Council at this site, there is no evidence of inappropriate disposal of agrichemical wastes through the outfall. Dioxin levels in marine biota are in accord with background levels elsewhere. There is no evidence of an environmental risk.

Ze Tank 3500

A known disposal site of 200 litre drums, that was rehabilitated in the 1980s..

A GPR survey was conducted at this site. The detailed record is presented in Appendix IV. The survey showed normal data across most of the site. Anomalous data in one area indicated the possibility of a large excavation or depression approximately 55 by 20 metres, to a maximum depth of 3 metres, and with strong anomalies indicating foreign objects, possibly metallic in nature. The GPR data was further confirmed by an electro-

magnetic induction survey to study the conductivity of the soil. The site was in the vicinity of the known Ngahoro dump site.

Following the receipt of this information, staff of the Council carried out three excavations within the area identified by the GPR operator as being the most critical area. This excavation found a bed of logs and stumps at a depth of 3 metres, in all three excavations. There was no evidence of a drum dumpsite or of the disposal or burial of any wastes. The detailed record of the excavations is presented in Appendix VIII.

No discharges from the area into the environment in the vicinity were found.

From the investigations carried out by the Council at this site, there is no evidence of ongoing site contamination, or of an environmental risk, since the site was remediated.

Zf IWD-3 South eastern corner of site, north of Site F

A site identified by former staff as an alleged disposal site.

A GPR survey was conducted at this site. The detailed record is presented in Appendix IV. The survey showed normal soil strata data across the majority of the site. In one area there was evidence of a previous excavation and buried debris or fill material. This corresponds to the alleged placement of wastes in this vicinity. There was no evidence of a drum dumpsite.

Samples of groundwater were collected from two groundwater monitoring bores maintained on the property. They were analysed for acid herbicides and for 2,3,7,8 TCDD. The results are presented in full in Appendix VII. The results are as follows:-no acid herbicides were detected in Bore 4, to the west of this area, or in Bore 3, to the east. The limits of detection were 0.1 parts per billion.

No 2,3,7,8 TCDD was detected in either bore. The limit of detection was 2-4 parts per quadrillion.

These results are at or below background levels of these chemicals.

From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial of drums at this site. There is no evidence of site contamination, or of an environmental risk.

The site is routinely monitored by the Council as part of an ongoing compliance monitoring programme.

Zg IWD-4 Western area, middle of site

An alleged site where drums were punctured by gun shots, identified by former staff.

No GPR survey was conducted in the area, as the allegations concerned the discharge of liquids onto the ground rather than burial, there are underground services in the area that would dominate GPR data, and iron pans in the vicinity would also interfere with the GPR data.

Site investigations conducted by plant staff since 1994, and reported on an ongoing basis to the Council, have separately identified two areas of ground with low levels of product contamination in this area. The contamination is believed to have come from leakage

from stored material, but the source of the discharge (whether deliberate or not) cannot be verified. The area is not a process area.

Samples of groundwater were collected from two groundwater monitoring bores, downflow of this site (4064, 4069). The results are presented in full in Appendix IX. The results were as follows:-of the eleven acid herbicides analysed for, 2,4 DB was detected at 0.1 parts per billion, fenoprop at 0.2 ppb, and picloram at 0.6 ppb, in Bore 49A. In Bore 46A, 8 acid herbicides were detected at concentrations of less than 1.3 ppb, and picloram at 11 ppb. These results confirm the data that has been supplied to the Council since 1994, and reported publicly through the Council's annual compliance reports for the site. They show no evidence of burial or disposal of agrichemical wastes at this site. Monitoring since 1994 has shown the levels to be steadily decreasing. Given this result, and the processes of natural attenuation and degradation, it is considered that there are no grounds for environmental concern..

No 2,3,7,8 TCDD was detected in either bore. The limits of detection were 10-20 parts per quadrillion.

From the investigations carried out by the Council, there is no evidence of inappropriate burial or disposal of agrichemical wastes at this site. Where there is evidence of groundwater contamination, there is no evidence of an environmental risk.

The site is routinely monitored by the Council as part of an ongoing compliance monitoring programme.

Zh Car park, Herekawe Stream

A site near the carpark near the Herekawe stream where cliff face seeps have been the subject of regular complaints to the Council.

A GPR survey was not conducted at this site.

A sample of sediment from immediately beneath the cliff face seepage was collected at this site. It were analysed for acid herbicides and for organochlorine pesticides. The results are presented in full in Appendix IX. The results are as follows:-no acid herbicides were detected in the sample. The limits of detection were 0.1 parts per million. No organochlorine pesticides were detected at this site. The limits of detection were 0.1-0.3 ppm.

These results are at or below background levels of these chemicals.

From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical wastes at this site. There is no evidence of contamination of the seep, or of an environmental risk.

Zi Herekawe cliff site (Pylon 4)

An alleged casual dumpsite.

A GPR survey was conducted at this site. The detailed record is presented in Appendix IV. The survey showed normal data across most of the site. Anomalous data in one area indicated the possibility of a couple of large objects or rock formations. The data showed no evidence of previous site excavations, a drum dumpsite, or other buried refuse.

Samples of seepage, sediment from 2 areas beneath the seepage zone, and surface soil were collected at this site. The seepage was analysed for acid herbicides and for organochlorine pesticides. The surface soil was analysed for 2,3,7,8 TCDD. This latter sample was collected from undisturbed soil, as requested by DIAG/DIN. The results are presented in full in Appendix IX. The results are as follows:- no organochlorine pesticides were detected in the seepage sample, at a limit of detection of 0.01-0.2 parts per billion. No acid herbicides were detected in the seepage sample, at a limit of detection of 0.1 ppb, except for picloram at a level of 0.2 ppb. 2,3,7,8 TCDD was detected in the surface soil sample at a level of 8.1 parts per trillion. The New Zealand agricultural guideline is 10 ppt, and the residential guideline is 1500 ppt.

From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical wastes at this site. There is no evidence of an environmental risk.

Zk Jury site

An alleged site relating to the existence of a large concrete bunker.

A GPR survey was not conducted at this site. Following a detailed site inspection, it was considered that there were no grounds to pursue investigations on this site any further.

Photographic analysis identified where a large bunker on the former IWD farm had been located. The bunker probably relates to this allegation (see page 7).

From the investigations carried out by the Council at this site, it was concluded that the original allegations concerned other sites rather than this one. There is no evidence of inappropriate burial or disposal of agrichemical wastes at this site.

5. Summary

This report represents the completion of Stage Two of the Council's investigations into allegations of the existence of dump sites arising from the inappropriate disposal of agrichemical waste from the Ivon Watkins Dow plant on Paritutu Road, New Plymouth. The disposal of such wastes, contaminated in particular with dioxin as a byproduct of the manufacture of herbicides 2,4,5-T and 2,4-D was alleged to have occurred between 1960 and 1980.

Stage One of the Council's investigations was the establishment of the 36 possible locations of such sites for further investigation.

The purpose of Council's action in Stage Two of this investigation was firstly to ascertain whether there was any environmental risk arising from any of the identified potential dump sites and secondly to ascertain whether any inappropriate dumping or disposal had occurred.

The sites identified for further investigation in Stage Two fell readily into four groupings. The first grouping covered 11 sites currently or historically held by IWD. All of these sites were known to and had been previously investigated by the Council, indeed five of the sites were the known dump sites rehabilitated in the 1980s.

The second grouping was of six sites where alleged historic surface contamination from stormwater from the IWD plant had occurred. The allegations on these sites did not involve dumping or burial of contaminated waste.

The third grouping of seven sites were known municipal landfills and sewage discharge outfalls operating during the period 1960 to 1980. With each of these sites there is no direct link to IWD. If disposal of contaminated wastes occurred it was in all probability in accordance with the standards of the time and undertaken by a range of parties ie, contractors, councils and the company.

The fourth grouping of twelve sites centres on alleged substantial dump sites and alleged contaminated seepages. This grouping was of sites generally not known or previously investigated by the Council and was identified in the course of the Stage One interviews.

Table 3 contains the recommendations and conclusions with respect to each site sorted by the groupings identified.

Table 3 Summary of recommendations

Group 1	**IWD premises (current and historical)**
F	IWD-1 From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical wastes at this site. There is no evidence of site contamination, or of an environmental risk.
U	IWD-2 From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial of agrichemical wastes at this site. There is no evidence of an environmental risk.
Zf	IWD-3 From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial of drums at this site. There is no evidence of site contamination, or of an environmental risk.
Zg	IWD-4 From the investigations carried out by the Council, there is no evidence of inappropriate burial or disposal of agrichemical wastes at this site. Where there is evidence of groundwater contamination, there is no evidence of an environmental risk.
M	Beach Road-1 From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical wastes at this site. There is no evidence of site contamination, or of an environmental risk.
N	Waireka Rehabilitated Dumpsite From the investigations carried out by the Council at this site, there is no evidence of an environmental risk arising from the low level continuing discharge of groundwater and leachate at this site.
R	Beach Road-2 From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical wastes at this site since the removal of known wastes and remediation. There is no evidence of site contamination, or of an environmental risk.
Z	Ngahoro From the investigations carried out by the Council at this site, there is no new evidence of inappropriate disposal of agrichemical wastes at this site, other than that already known and remediated. There is no evidence of a significant environmental risk.
Ze	Tank 3500 From the investigations carried out by the Council at this site, there is no evidence of ongoing site contamination, or of an environmental risk, since the site was remediated.
Zb	Buller Street From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical wastes at this site. There is no evidence of contamination above recognised guidelines, or of an environmental risk.

Zc	Tarahua Road Following a detailed site inspection and discussion with the current owner, no further investigations were considered justified or were undertaken. The site is effectively capped by buildings and paved areas, such that there is no risk pathway even if contamination did exist.
Group 2	**Alleged IWD stormwater discharges**
D	34 Rangitake Drive From the investigations carried out by the Council at this site, there is no evidence of the use of this site as a drum dumpsite or for the inappropriate burial or disposal of agrichemical wastes. Council staff will liase with the site owner if any further work to determine the nature of the objects shown in the GPR data is desired. There is no evidence of site contamination, or of an environmental risk.
Da	44 Rangitake Drive From the investigations carried out by the Council at this site, there is no evidence of the use of this site as a drum dumpsite or for the inappropriate burial or disposal of agrichemical wastes. Council staff will liase with the site owner if any further work to determine the nature of the objects shown in the GPR data is desired. There is no evidence of site contamination, or of an environmental risk.
L	23C Tahurangi Place From the investigations carried out by the Council at this site, there is no evidence of inappropriate disposal of agrichemical wastes at this site. There is no evidence of site contamination, or of an environmental risk.
P	26A Rangitake Drive From the investigations carried out by the Council at this site, there is no evidence of the use of this site as a drum dumpsite or for the inappropriate burial or disposal of agrichemical wastes. Council staff will liase with the site owner if any further work to determine the nature of the objects shown in the GPR data is desired. There is no evidence of site contamination, or of an environmental risk.
V	Centennial-2 From the investigations carried out by the Council at this site, there is no evidence of inappropriate discharge of agrichemical wastes at this site. There is no evidence of an environmental risk.
W	Herekawe Stream From the investigations carried out by the Council at this site, there is no evidence of any effects arising from inappropriate burial or disposal of agrichemical wastes at this site. There is no evidence of contamination, or of an environmental risk.
Group 3	**Municipal waste disposal systems**
G	Marfell Park (landfill) From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical-contaminated wastes at this site. There is no evidence of contamination of the site by such wastes, or of an environmental risk.
H	Ngamotu Domain (landfill) From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical-contaminated wastes at this site. There is no evidence of contamination of the site by such wastes, or of an environmental risk.
O	Pioneer Road Another identification of the Ngamotu Domain site (see site H).
I	7A Squire Place From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical wastes at this site. There is no evidence of site contamination, or of an environmental risk.
Q	Rifle Range Road/Bewley Road (landfill) From the investigations carried out by the Council at this site, there is no evidence of the use of this site as a drum dumpsite, or of inappropriate burial or disposal of agrichemical wastes at this site. There is no evidence of contamination of the site by agrichemicals, or of an environmental risk.
T	Colson Road landfill From the routine ongoing monitoring carried out by the Council at this site, there is no evidence of the use of the site as a drum dumpsite, or of the inappropriate burial or disposal of agrichemical wastes at this site. There is no evidence of contamination of the site by agrichemicals, or of an environmental risk.

Zd	Tasman Sea (Elliot Street outfall) From the investigations carried out by the Council at this site, there is no evidence of inappropriate disposal of agrichemical wastes through the outfall. Dioxin levels in marine biota are in accord with background levels elsewhere. There is no evidence of an environmental risk.
Group 4	**Alleged burial/seepages**
A	Lawry Street From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical wastes at this site. There is no evidence of site contamination, or of an environmental risk.
B	Seaview Road From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical wastes at this site. There is no evidence of site contamination, or of an environmental risk.
C	Pylon 3 From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical wastes at this site.
Ca	Centennial Drive From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical wastes at this site. There is no evidence of site contamination, or of an environmental risk.
E	Omata Reserve From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical wastes at this site. There is no evidence of site contamination, or of an environmental risk.
J	Belt Road From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical-contaminated wastes at this site. There is no evidence of site contamination, or of an environmental risk, either on the site or in the adjoining marine environment.
K	Victoria Road, Oakura A detailed site inspection by Council staff found no reason to conduct further investigations. From the investigations carried out by the Council at this site, while there was unorthodox weed control operations, there is no evidence of inappropriate burial of agrichemical wastes at this site.
Za	60 Marama Crescent From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical wastes at this site.
Zk	Jury site From the investigations carried out by the Council at this site, it was concluded that the original allegations concerned other sites rather than this one. There is no evidence of inappropriate burial or disposal of agrichemical wastes at this site.
X	Roto Street From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial of drums or disposal of agrichemical wastes at this site. There is no evidence of contamination of the seep, or of an environmental risk.
Zh	Car park From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical wastes at this site. There is no evidence of contamination of the seep, or of an environmental risk.
Zi	Herekawe cliff site (Pylon 4) From the investigations carried out by the Council at this site, there is no evidence of inappropriate burial or disposal of agrichemical wastes at this site. There is no evidence of an environmental risk.

In conclusion the results of the Council's Stage Two investigation indicate:

- There is no evidence that any disposal of agrichemical wastes at sites (other than those already known as disposal sites) has led to environmental contamination. In particular, no contamination was found at or near any residential property.

- At the known sites, this investigation has confirmed what was already known or expected to be the situation, in respect of the presence and levels of some agrichemical contaminants.
- There is no evidence of environmental risk at any site, or in the marine environment in the vicinity of those sites that were on the coast.
- No new drum dumpsites have been found.

The Council at this point has no evidence that any further action is required at any of the sites investigated.

Appendix I

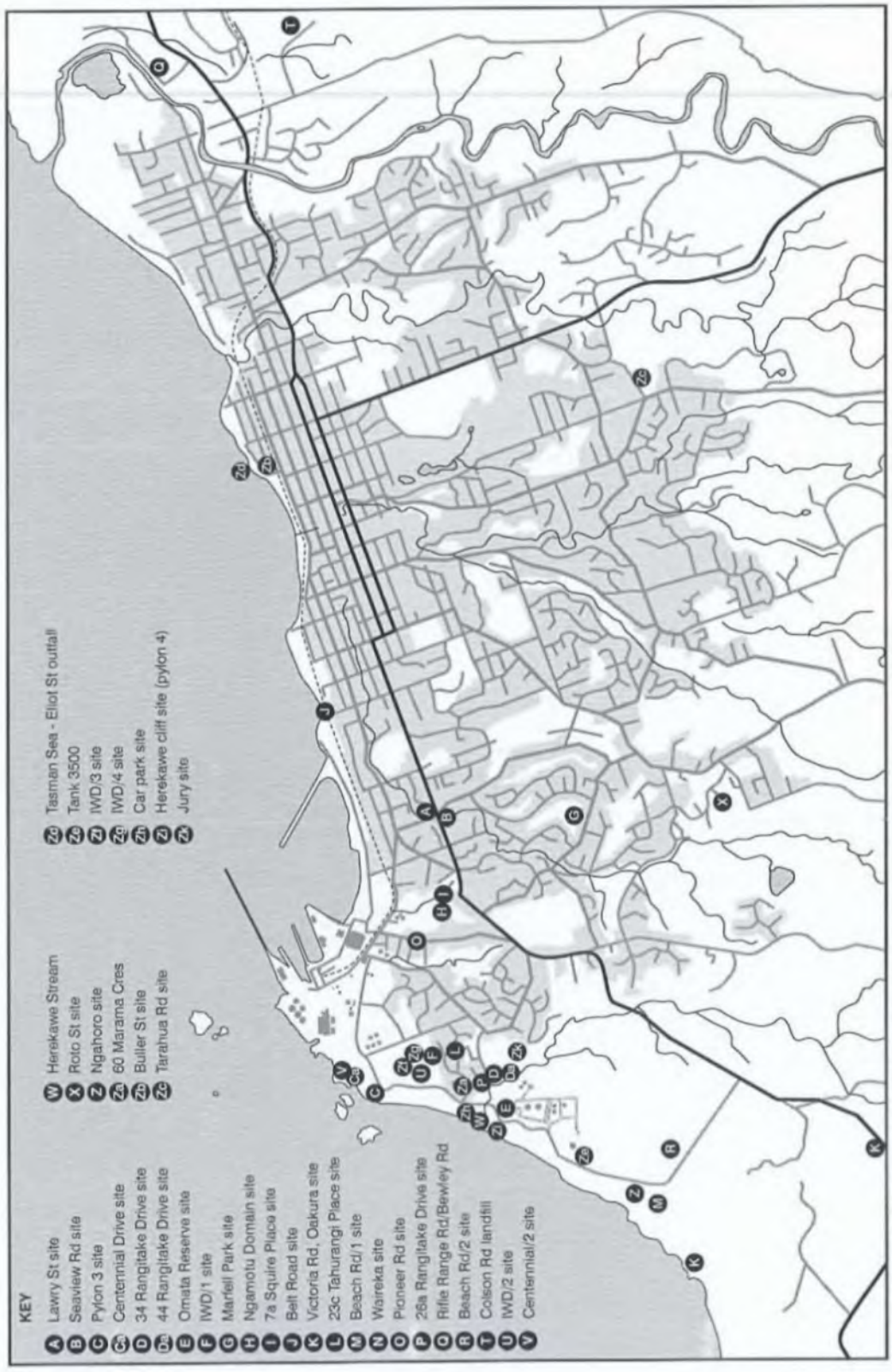
Record of interviews

Contact ID	Name	Officer	Date of contact	Site reference
001	Andrew Gibbs	Brian Calkin	14-12-01	A-J
002	Douglas and Geoffrey Black	Brian Calkin	16-02-01	K-Victoria Rd
003	Joanne Ngaia	Brian Calkin	22-02-01	L-23C Tahurangi
004	Steve Tooley	Brian Calkin	22-02-01	M-Ngahoro
005	Moturoa Primary School	Bruce Pope	23-02-01	N/A
006	Wayne Baker	Bruce Pope	01-02-01	Fa-Paritutu-2
007	Kennedy's Gardens	Bruce Pope	01-02-01	N/A
008	Eric Schwass	Bruce Pope	23-02-01	P-26A Rangitake
009	Trevor Humphries	Brian Calkin	27-02-01	H & J
010	Ted Burrows	Brian Calkin	27-02-01	Zb-Buller
011	Ross McDonald	Bruce Pope	23-02-01	Q-Rifle Range
012	Ian McLeod	Bruce Pope	22-02-01	Da, M, T & Y
013	Ian Wishart	Brian Calkin	07-03-01	N/A
014	Sam Lowe	Bruce Pope	23-02-01	R-Beach Road
015	Belt Road Motor Camp	Brian Calkin	22-02-01	J-Belt Road
016	Neil Herdson	Bruce Pope	22-02-01	N-Waireka
017	Hilton Alsop	Bruce Pope	26-02-01	N/A
018	Grant Webster, Aim Demolition	Brian Calkin	22-02-01	Zd
019	Julie Warren	Bruce Pope	26-02-01	N/A
020	Ian Barnes	Bruce Pope	22-02-01	N/A
021	Murray Wells	Bruce Pope	22-02-01	N/A
022	David Law	Bruce Pope	22-02-01	S (now included with I)
023	New Plymouth District Council	Brian Calkin Catherine Law	28-05-01	Various
024	Mrs Clarke	Brian Calkin	Not traced	Not traced
025	Kathryn Parker	Brian Calkin	01-03-01	C
026	Paddy Burt	Brian Calkin	22-02-01	C, Da, J & various
027	Frances George	Brian Calkin	28-02-01	N-Waireka
028	Ray Looney	Bruce Pope	deceased	deceased

029	Pam Broughton	Bruce Pope	Not traced	No information
030	Trevor Fleming	Bruce Pope	28-02-01	G-Marfell
031	Les Balsom	Bruce Pope	14-03-01	N/A
032	Ashley Heydon	Bruce Pope	05-03-01	N/A
033	Brian Martin	Brian Calkin	deceased	deceased
034	Tim Wells	Brian Calkin	28-02-01	N/A
035	Brian Grant (Kibby's)	Brian Calkin	28-02-01	M & N
036	Bruce Pope	Brian Calkin	28-02-01	F-Paritutu-Dow
037	Chris Burr	Bruce Pope	05-03-01	N/A
038	Maurice Vickers	Brian Calkin	05-03-01	F-Paritutu Dow
039	Noel Pickford	Brian Calkin	05-03-01	N/A
040	Jenny ?	Brian Calkin	01-03-01	Not traced
041	Gerry Gerard	Bruce Pope	01-03-01	M-Ngahoro
042	Brian Gundersen	Bruce Pope	01-03-01	No information
043	Bill Wanstall	Bruce Pope	01-03-01	M-Ngahoro
044	Cheryl Dormer	Bruce Pope	05-04-01	No information
045	Stuart Glen	Bruce Pope	12-04-01	No information
046	Tom Dean	Bruce Pope	12-04-01	No information
047	John Goldworthy	Bruce Pope	12-04-01	No information
048	Bullocks Wanganui	Brian Calkin	27-03-01	N/A
049	Brian Neilson	Bruce Pope	09-03-01	F-Paritutu
050	Dale Feelan	Bruce Pope	09-03-01	X-Roto
051	W & M Usher	Brian Calkin	28-03-01	D-Rangitake
052	Don Sarten	Brian Calkin	08-04-01	F & D
053	Roebucks	Brian Calkin	29-06-01	No information
054	Noel Krutz	Bruce Pope	19-03-01	Z-Ngahoro 2
055	Chris Hickey	Bruce Pope	02-04-01	Z-Ngahoro-2
056	Athol Rowe	Bruce Pope	20-03-01	U-Centennial 3
057	Roy Drake	Bruce Pope	20-03-01	Y (now included with Q)

058	Kerry Tatley	Bruce Pope	26-03-01	N/A
059	Peter O'Donnell	Brian Calkin	20-03-01	U
060	Jason Eade	Bruce Pope	03-04-01	N/A
061	Margeret Sullivan (Jnr)	Bruce Pope	03-04-01	N/A
062	Frank Ferrier	Bruce Pope	03-04-01	N/A
063	Melanie Bovey	Bruce Pope	04-04-01	L-Tahurangi
064	Mrs Scrivener	Bruce Pope	23-04-01	No information
065	Jason Ray	Bruce Pope	20-03-01	Y (now included with Q)
066	Doctor Mike Patric	Brian Calkin	11-04-01	N
067	Colin Mercer	Brian Calkin	06-04-01	N
068	Dorothy Doig	Brian Calkin	Ist meeting	D, L & P
069	Margaret Scannell	Brian Calkin	11-04-01	D
070	Gabrielle Alsop	Brian Calkin	10-04-01	Various
071	Dot Browning	Bruce Pope	Not traced	No information
072	Mrs Askew	Bruce Pope	20-04-01	No information
073	Patricia Austin	Brian Calkin	10-04-01	General
074	Brian Williams	Brian Calkin	10-04-01	I & S
075	Geoff Smales	Brian Calkin	10-04-01	No information
076	Maori lady, Waitara	Brian Calkin	Not traced	Not traced
077	Maureen Wakeman	Brian Calkin	17-04-01	No information
078	Noel Hayman	Brian Calkin	17-04-01	G
079	Jane ?	Brian Calkin	Not traced	Not traced
080	Eva Jury	Brian Calkin	20-04-01	Zk
081	Raywyn Baylis	Bruce Pope	20-04-01	General
082	Isabell O'Donell	Brian Calkin	Not traced	No information
083	Bert Squire	Bruce Pope	08-05-01	I
084	Bruce Coxhead	Bruce Pope	16-08-01	R

Appendix II
Map



Alleged Historical Dioxin Disposal sites.

Appendix III
Sampling protocols

Taranaki Regional Council: Sampling protocols for dioxin investigations at alleged historical sites

This protocol has been prepared by Gary Bedford, Technical Services Manager, Brian Calkin, Inspectorate Manager, and John Williams, Laboratory Manager, Taranaki Regional Council.

Date of preparation: 5 June 2001

This version supersedes all earlier versions

Objective

These sampling and analytical protocols relate to part of an investigation that the Taranaki Regional Council is conducting into determining the whereabouts and possible environmental risk of alleged 'dioxin dumps' in the New Plymouth area. As part of a suite of investigative techniques, the Council has determined to collect water and soil samples, as appropriate, at sites identified to Council staff as possibly having been used for the dumping or disposal of agrichemical- related wastes. The sampling programme is designed as part of an initial screening of the possible sites, and is not intended to be a comprehensive or exhaustive site investigation. Further study - e.g. background sampling, analysis of individual samples, the collection of additional samples at a greater intensity, etc, would be considered in the event that a risk is indicated based on average results being above guideline or known background values.

The Council is focusing on whether there is an actual or plausible environmental risk at any of the sites. It is considered that the primary route of exposure would be by release from any buried reservoir, via leaching into groundwater and thence into the surface environment. Therefore the sampling regime has as its fundamental requirement, that any seeps, drains, pipes, or other forms of leachate discharge must in all cases be sampled. These will be analysed for a range of contaminants that would indicate the possible presence of dioxins, as well as being environmental contaminants in their own right (namely acid herbicides and organochlorine pesticides).

For the sake of cost effectiveness, at each site visited, samples will also be simultaneously collected (depending on site specific factors) of surface soils, receiving waters such as flows in streams or drains, sediment from within water courses, and from soil surfaces over which seeps/ leachate flows.

Should the analysis of seep and leachate samples, or other physical evidence, indicate the probability that a site is likely to have been used for the dumping of dioxin-containing wastes, then the Council will consider the value of having any or all site samples analysed for 2,3,7,8 TCDD. The analysis for 2,3,7,8 TCDD is based in part on the much higher cost of analysis for a full suite of dioxins, in part on the fact that 2,3,7,8 TCDD is the dioxin of most concern from a health perspective in any case, and in part on the fact that 2,3,7,8 TCDD is the primary 'marker' of dioxin contamination in 2,4,5-T.

In addition, the Council would review the need for further, more detailed site-specific investigations e.g. core drilling and sampling, groundwater sampling, more intensive soil sampling, and/or biological surveys, at any site where chemical analysis of leachate indicates the presence of a dioxin-containing reservoir of wastes.

It should be clearly understood that this is a targeted programme to identify possible environmental risk from alleged dump sites. It is not intended to conclusively prove or disprove whether dioxin- containing wastes are present within a site, nor to provide data on concentrations of dioxin in surface soils generally throughout the suburb of Spotswood.

Contents of protocol

This protocol covers container preparation, soil sampling, water sampling, analysis, and field sheet usage. It also includes a description of each site that gives the basis of the sampling regime to be used at each site. It also lists the compounds to be analysed for by AgriQuality.

These protocols have been based on and should be read in conjunction with the Council's existing practices and the Ministry for the Environment's "Health and environmental guidelines for selected timber treatment chemicals"(1997). Some matters have also been drawn from the protocols used by the Ministry in its national organochlorine programme (1995-1998).

Container preparation

To ensure the integrity of the sample, all sample bottles and jars used must be clean. The Council has received pre-cleaned containers from AgriQuality. The Council will also be providing containers, cleaned using the protocol set out below. All containers received from AgriQuality will be returned to them, as part of the contractual arrangement for analysis. Because the scope of sampling is larger than originally envisaged, the Council will send additional samples to the laboratory in its own containers, as well as providing duplicates of some samples to DIAG and site occupiers. The Council will provide containers for this purpose.

The Council will also provide duplicates of all samples to Dow AgroSciences (attention Marie Gibbs). The Company is undertaking to provide its own containers.

In order to validate the preparation of its own containers, the Council will forward field blanks in its own containers for analysis, as well as using AgriQuality's containers.

The cleaning procedure is as follows::

All solvents must be either of Analar grade or distilled-in-glass. Solvents must be stored in, and dispensed from, glass wash bottles that have also been cleaned by this protocol.

- A glass bottle/jar is washed/soaked with warm water and detergent
- The bottle/jar is rinsed three times with tap water and once with distilled or de-ionised water
- The bottle/jar is rinsed three times with acetone and allowed to drain well between rinses
- The bottle/jar is rinsed three times with hexane and allowed to drain well between rinses
- The bottle/jar is allowed to dry well on a drainage rack

The caps/lids of the sample containers must be either teflon lined or lined with aluminium foil Domestic or catering grade aluminium foil is suitable for this purpose. The foil must first be rinsed before use with acetone followed by hexane and allowed to drain dry.

Aluminium foil may also be used at times during the sample collection procedure. In such cases, the aluminium foil must first be rinsed with Analar grade or distilled-in-glass acetone followed by Analar grade or distilled-in-glass hexane and allowed to drain dry. All aluminium foil must be washed following this procedure, regardless of whether the foil comes into direct contact with the sample or not.

Field work

Ensure personal diaries record each site visit and that they are kept up-to-date. A Council field sheet must be used to document every sample. An example is attached as Appendix 1. These have been prepared having regard to the Ministry for the Environment's national organochlorine programme.

Copies of all field sheets are to be given to Flo Tolland, Administration Officer (Inspectorate). Originals are to be given to John Williams, Laboratory Manager.

Before commencing field work, staff should refer to the check list (Appendix 2) to ensure they have all the necessary equipment at hand.

Site sampling plans

A preliminary sampling plan for each site is attached to this document (Appendix 6). Prior to commencement of the sample collection phase consideration will be given to GPR results, and an intensive on-site examination by Council sampling and/or inspectorate staff undertaken to confirm, mark and document all sampling points associated with each dump site.

Sampling strategy

The sampling strategy selected and the data generated from this investigation target at each site, the site media and locations that are considered most likely to indicate the presence of dioxin -containing wastes or other agrichemical wastes, and that pose the greatest potential to result in exposure to such wastes. This will involve sampling one or more of the following:

soil, leachate, sediments, surface water, groundwater seepage, and marine biota.

Sampling programme

This section provides detailed information pertaining to the sampling programme with which all sampling personnel must be familiar. It covers all aspects of the sampling strategy, sample size and identification, the collection procedure, sample packaging and shipping, chain of custody record information and quality assurance and quality control requirements. These protocols should be read in conjunction with Section 3 of the Ministry for the Environment's 'Health and environmental guidelines for selected timber treatment chemicals'(1997). This protocol adds to, or,where there is a conflict, supersedes the MfE guideline.

It is critical to this programme that:

- All information and procedures provided are carefully followed.
- Sample integrity is maintained at all times. In particular, every precaution should be taken to minimise sample contamination in the field.

- There is accurate traceability of samples throughout all stages of the programme. Particular care should therefore be given to all aspects of sample identification and documentation and chain of custody (Appendix 3)
- All aspects of the sampling programme, especially deviations to the sampling procedure or problems in the field, are thoroughly documented on the field sheet.

The potential for field contamination of a sample can be minimised by carefully following the procedures documented. In addition, the following precautions should be observed:

- Minimise contact of the sample during the collection process, and exposure of the sample to materials other than the sample containers once collected.
- Avoid contact of the sample with plastic materials at all times.

Sample replication

The Council is providing duplicates of some samples to DIAG and site occupiers. The Council will provide containers for this purpose.

The Council will also provide duplicates of all samples to Dow AgroSciences (attention Marie Gibbs, or Ann Coles, or Julie Tidswell). The Company is undertaking to provide its own containers.

Soil sampling

Purpose

The purpose of the soil sampling is that, where analysis of leachate or seepage for acid herbicides or organochlorines indicates the likely presence of a dioxin source within the site, then the soil sample(s), which would have been collected at the same time, will be analysed for the specific dioxin 2,3,7,8 TCDD to determine whether there is an exposure pathway via surface soil from that source, and any consequent health risk that may arise to any regular or longterm user of the site. To this end, the question to be answered is that of the overall average concentration of dioxin on the site, or any particular sub-area of a larger site. Therefore analysis of composited soil samples will be carried out.

This approach is not designed nor intended to find and isolate any particular 'hotspot' that may be present at one point within an entire site, but it is intended to be able to detect differences in exposure levels between sites and background levels, or between sub-areas of larger sites. The need for and design of a study to determine the full range of contaminant concentrations and to detect 'hotspots' would be considered subsequently (e.g. a surface grid sampling regime with every plug individually analysed).

If there are site-specific considerations that suggest that surface soil have been contaminated by the disposal of dioxin-containing wastes, then regardless of whether these sites have leachate or seepage points and the results of analysis of those points, then surface soil will be analysed for 2,3,7,8 TCDD. In particular, at the sites of most concern to the local dioxin investigation group (up to 5, to be nominated by the group), analysis for TCDD in surface soils and/or sediments will be performed in any case.

Sampling methodology

All soil samples collected will be a composite of a number of individual cores. In all cases, cores will be 2.5 cm in diameter, taken to a 7.5 cm depth. As far as practicable, all plugs should be of a uniform size (depth).

Collect samples at least 5 metres distance from any man made wooden object or structure (for example fences posts, telegraph poles, foundations) at the sampling site[1].

The number of individual plugs of soil to be collected at each site will be determined by site-specific characteristics at the time of sampling, but must comply with the general requirements as set out below.

Enough individual plugs should be collected across a site to give a reasonable intensity of coverage. Taking into account areas that should not be sampled because of other potential sources of contamination, as described above in the first paragraph, plugs should be taken at points spread across the entire site and representing site usage(s).

Given that it is intended to analyse several plugs combined as one large representative soil sample, for a large site there should not be so many plugs that any contaminated soil in the proximity of a single dump on that site is diluted down to background levels by an overwhelming number of plugs sampled from elsewhere on the site.

Therefore it is proposed that a minimum of 4 and a maximum of 6 plugs be collected from any single site (or sub-area of a site, as described further below), and combined into a single container. Plugs should only be combined into a single container to be treated as a single sample when collected from an area of similar character or likelihood of exposure. All plugs at the one site can be taken without decontaminating the sampling probe between plugs. However, where a site has been subdivided for the purposes of soil sampling as described below, then separate composites from each part of the site should be made, and a clean probe used for each new part of the site.

On a large site, the site should be divided into sectors each of no more than $400m^2$, (e.g. a square of no more than 20x 20 m), and one plug should be collected from within each sector. If the entire site is larger than 6 sectors x 400 m^2 per sector, then the site should be sub-divided and each sub-division treated as a separate site, for the purposes of soil sampling (i.e. 4-6 plugs collected from each sub-area). The site may also be sub-divided for the purpose of surface soil sampling on the basis of topographical features or access considerations e.g. a number of small plateaux down the side of a hill should be considered as separate potential dump sites, even if all in the same general locality, or where a stream or other feature that would have restricted the discharge of wastes to part of a site is present.

The sampling probe and rod for removing the soil plug from the probe must be decontaminated between each new site.

Collection of soil samples and equipment preparation

Soil samples are to be collected into the 1 litre wide-mouth screw capped glass jars provided, precleaned using the rigorous cleaning procedure detailed above. To ensure the integrity of

[1] Wooden structures of this type may have used pentachlorophenol (PCP) treated timber. PCP contains dioxin impurities.

the sample, it is important that samples are collected only in the jars supplied. The lids of the jars should be lined with aluminium foil (hexane rinsed). It is important to ensure this foil lining remains in place and unbroken.

To avoid sample contamination, the lid of the jar should only be opened immediately prior to the collection of the sample. Once the sample has been collected the lid should be secured firmly.

The plug of soil can be pushed from the probe into the sample container using a rod covered with aluminium foil, cleaned as described below.

All cores from each site (i.e. up to six cores) should fit comfortably into each 1 litre jar.

All sampling equipment used, including a stainless steel soil corer (25 mm diameter), stainless steel scissors for trimming grass over the sample and a stainless steel spoon for compacting samples in the jar are to be cleaned thoroughly by washing in water (detergent and warm water, then rinsing in tap water, then final rinse in deionied water) followed by rinsing with acetone and hexane. Equipment is to be cleaned at the commencement of a day's sampling, and between sampling stations. Solvents used in the field for decontamination of equipment between sites is to be recovered and returned to the Council premises.

At each new site for investigation, the previously cleaned stainless steel soil corer is to be used to collect 5 cores, all of which are discarded, before the next plug becomes the first plug from that site to be retained for analysis. This procedure adds one more 'cleaning' step to the process. It is based on the field sampling protocols used by the Minuistry for the Environment's national organochlorine programme.

Prior to sample collection, any grass over the sampling area to be trimmed to ground level, fresh and weakly decomposed pasture litter removed, and particular care taken to avoid any possible contamination of the sample. Procedures to achieve this include:

- no contact of the sample with plastic material;
- minimising any direct contact of the sample during the sampling processes with any item other than the soil corer and the rod used to expel the plug from the probe into the sample container;
- avoiding any exposure of the samples once collected with any materials other than the sampling containers;
- rigorous cleaning procedure of the soil corer and other sampling items between the collection of soil cores from different sampling locations.

Soil cores will be 25 mm in diameter, and should be taken to a depth of 75 mm. Following collection, each soil core should immediately be placed in a precleaned glass collection jar. Once all soil cores are collected from a sampling site, the sample is to be given a unique identification number, the jar labelled, and a custody seal fixed over the screw cap. Jars are to be placed in a chillibin with frozen pads to keep samples cool.

Instructions for interim storage and dispatch for analysis are set out below.

Water sampling

All sample collection jars to be precleaned in the same manner as the soil sampling equipment (water, acetone, hexane) prior to use, and used with aluminium foil (hexane rinsed) lined lids.

Grab samples should be taken from the middle of any stream or open drain, in the flowing reaches, in glass one litre bottles. Samples are to be taken facing upstream to the flow, and with the bottles fully submerged whenever possible.

Each grab sample is to be obtained, where practical, by field sampling personnel entering the drain and moving slowly upstream to a suitable position within the drain whilst facing upstream at all times. From this position and holding a sample bottle by the main body of the vessel, and at arm's length, the bottle is to be immersed, uncapped, filled to the neck, and recapped whilst still under water. Avoid the collection of any disturbed sediment from earlier movements within the watercourse.

Each sample is to be given a unique identification number, the jars labelled, and a custody seal fixed over the screw cap. Jars are to be placed in a chillibin with frozen pads to keep samples cool.

Instructions for interim storage and dispatch for analysis are set out below.

Sediment sampling

Sediment samples will be collected from water courses downstream of potential points of discharge of contaminants originating from each burial site. The reasoning is that sediments will probably have higher concentrations of organic contaminants than would occur within the receiving water column, and have the potential to affect benthic communities.

Material will be sampled from beneath and/or adjacent to site drainage points including seeps and any leachate tracks. For larger streams, sediments deposited downstream of alleged or known burial sites will be collected.

Cleaning of equipment used and precautions taken in sampling will as set out in these protocols.

Sediment samples shall be collected either by (i) using the soil core sampler, or (ii) forcing the sample container directly into and along the sediment bed, so as to scoop up sediment, or (iii) sampling using a small glass jar (cleaned as per these protocols) and transferring the contents to a clean glass jar, if needs be several times in order to capture a sufficiently large or repreentative sample.

Sediment samples should contain only the minimum of water. Without losing any fine sediment material, the container should be filled with sediment, or free water decanted off in the field.

Individual sediment samples from different locations within one stream bed are not to be combined.

The labelling and interim handling of sediment samples is to be as for soil samples.

Leachate sampling

All leachate points identified at each dump site will be sampled in this investigation. Such points are considered to be primary exposure pathways for mobile contaminants. If there are multiple leachate discharge points on one site, each is to be treated separately.

Equipment preparation and sample collection/handling will be consistent with these protocols.

Chain of custody and transportation for all samples

Following collection, each sample to be given a unique identification number, and each individual bottle labelled, and a custody seal fixed over the screw cap. Each sample to be packed in a polystyrene box/chillibin, frozen chilli pads added, and the box delivered to NZ Couriers, 493A Devon Street East, New Plymouth, along with a chain of custody form (Appendix 3). Samples are to be sent by overnight courier to the analytical laboratory (AgriQuality). Address for courier delivery is Ultra Trace Laboratory, AgriQuality, Gracefield Research Centre, 71 Gracefield Road, Gracefield, Lower Hutt (attention Scott Leathem).

Each sample will also be logged in the Taranaki Regional Council's sample register, in compliance with the Council's standard procedures as set out in the Chemistry Laboratory's documentation.

Container label (example)

Sample Description: _____

_____ Sample No.: _____

Date: _____ Submitted By: _____

For Laboratory Use Only

Laboratory Number: _____ Date: _____

Quality assurance and quality control

Specific quality control measures are to be included with the sampling activities. This involves collection of duplicates and blank samples. Duplicate samples will give an indication of sampling and analytical precision, and various types of blank samples including equipment rinsate and field blanks, an indication of sampling bias.

At least one quality control sample (duplicate or blank) is to be collected or prepared for every site visited.

Equipment rinsate blanks are analyte-free deionised water used to rinse the sample equipment and thereby demonstrating the effectiveness or otherwise of the equipment cleaning procedures outlined in this protocol. These blanks are to be collected after the cleaning process but prior to reuse for sampling.

In addition to the above, one or two sampling containers will be returned to the testing laboratory unopened so as to demonstrate the cleanliness of prepared bottles supplied by either the Council or the testing laboratory itself.

Field blanks in the context of this investigation are to be ambient media similar to the sample matrix. Samples collected from documented local control sites will be used as field blanks by exposing them to the sampling environment at the sampling site. This may be soil at one site and upstream surface water at another.

A control sample should be collected of surface soil from either Marsland Hill, Churchill Heights, or Brooklands Park, New Plymouth. These sites were sampled in the MfE national organochlorine programme, and a dioxin analysis of soil from one of these sites should confirm the analytical results of this current investigation.

These blanks will reflect ambient incidental or accidental sample contamination during sampling and analytical process.

Instructions will be given to the laboratory in regard to which samples are to be tested. The Council will include some of the quality control samples in its analytical requirements.

AgriQuality will not be advised which samples have been prepared as quality control samples and which samples are discharge or field samples.

Sample processing requirements

Specific instructions will be provided to the analytical laboratory in regard to processing and testing of samples submitted as part of this investigation.

All samples must be retained by the laboratory until specific instructions to dispose of them are provided by the Council.

Soil samples

One litre jars containing 4-6 cores will be submitted to the laboratory. The contents of these jars will be composited and processed in accordance with the laboratory's own procedures.

Sediment samples

Excess water in sediment samples that separates after standing overnight is to be decanted off and discarded. In doing so, any fine sediment layer must not be disturbed.

Instructions for disposal are the same as for soil samples.

Water samples

Surface and groundwater samples containing particulate matter are to be processed as is, i.e., without filtration or decanting.

Duplicate samples

Duplicate samples will not be identified as such when submitted to the laboratory. They are treated and tested as separate samples. Field sheets must however clearly identify the nature of each sample, including all quality control samples of any sort.

Rinsate and field blanks

About 10% of both rinsate and field blanks will be tested initially. Any decision as to the testing of the remainder will be based on whether or not any contamination problems are identified or any suspect field sample results obtained.

Analytical regime

The details of the compounds that will be analysed for, and the limits of detection for each compound, are attached to this document (Appendix 4). The limit of detection to be used for the 2,3,7,8 TCDD analysis is 10 ppt in soils, and 1 ppt in water samples.

Initially only the leachate/groundwater and any stream samples would be analysed. The purpose is to identify whether any agrichemical wastes have been buried at the site as a reservoir for dioxins as well as an environmental risk in their own right. At sites for which there are no leachate/seepage samples, and for sites nominated for dioxin analysis of surface soils by the dioxin action group, and at any site where site specific features indicate the likelihood of surface soil having been contaminated by the burial of dioxin-containing wastes, then TCDD analysis of soil will be required.

The analysis will be for acid herbicides (which will capture any 2,4-D, 2,4,5-T, MCPA, MCPB, and a number of other compounds) and for organochlorine pesticides (which will capture DDT and its decomposition products, lindane, dieldrin, endrin, and a number of other compounds). Method references are given in Appendix 5.

Should evidence of the presence of any of these compounds arising from burial or disposal be found, then all the samples for that site e.g. soil and sediment samples, as well as the leachate/groundwater and stream samples, will be analysed for the 2,3,7,8 TCDD isomer of dioxin, as the most significant dioxin associated with 2,4,5-T. In this way, information on acid herbicides and organochlorine pesticides and dioxinsat that site will be gained.

The Council has also made the offer to the dioxin investigation group that regardless of the outcome of the acid herbicide and organochlorine screens, then at the sites of most concern to the group analysis for TCDD in soils and sediments will be performed in any case.

Health and safety

Health and safety of personnel is of prime importance in the implementation of any sampling programme.

Routine procedures outlined in the Council's Workplace Health and Safety Guidelines and Operating Manual for Field Staff, must be adhered to.

This includes:

(a) two personnel on site;

(b) use of personal protective equipment as appropriate, e.g. eye protection, use of gloves, overalls and suitable footwear;

(c) being aware of the potential physical and chemical hazards associated with each sampling site (note: because these sites are not familiar to the Council, staff must accept responsibility for their own safety including assessing each site for possible hazards and being aware that not all hazards can be identified beforehand).

(d) access to a first aid kit and RT or cellphone in case of emergency;

(e) use of experienced personnel for sampling.

(f) This particular programme involves the use of solvents for on-site cleaning of equipment, therefore access to a respirator will be necessary.

Appendix 1

Taranaki Regional Council field sheet
(every sample to be recorded on the sheet for the property studied)

Dioxin Investigation

Site Name: _____

Weather: _____ Job No: _____

Sampled By: _____ Project: _____

Witness: _____ Date: _____

Sample Description	Sampling Point	Time (actual)	Conditions/Comments/ Instructions to Lab/Deviations from protocols/Difficulties/Sampling depth, flow	TRC Sample ID No.

Samples Handed to Courier Firm:		Registration	Check
By:		By:	
Date:	Time:	Date:	

Appendix 2

Dioxin investigation field check list

Dioxin investigation equipment checklist

date										
field sheets	soil									
	surface water/leachate									
	sediment and banks									
sampling protocol										
chain of custody forms										
carbon paper										
courier stickers										
packaging tape										
dispatch labels										
snaplok bags										
custody seals										
camera										
GPS										
tape measure										
prepared sample containers - agriquality										
prepared sample containers - other										
chilly bins										
cool packs										
Thermometer?										
safety gear	rubber boots									
	overalls									
	respirator for solvents									
	gloves - disposable									
	gloves - nitrile									
	glasses/goggles									
sampling gear	soil corer									
	folded cleaned foil to go under foot									
	flat edged funnel or equiv.									
	sediment scoop									
	spoon or plunger									
	stainless steel scissors									
	plastic sheet									
	cleaned foil sheet									
cleaning gear	pyroneg									
	hot tap water									
	cold tap water									
	DI water									
	Acetone									
	Hexane									
	bucket									
	brushes									
	solvent waste container and funnel									
Spare foil for replacement lid liners, wrapping cleaned sampling gear etc										

Appendix 3
Chain of custody sheet

AgriQuality NEW ZEALAND

Please fax back as soon as possible

CHAIN OF CUSTODY RECORD

(Please ensure all information is entered legibly and all entries are made with waterproof, permanent ink)

SAMPLE INFORMATION (to be completed by sender)

COMPANY NAME		CLIENT CONTACT
ADDRESS		PHONE
		FAX
SENT BY (Signature):	DATE SENT	METHOD OF SHIPMENT

Please confirm Samples received in good order with security seals intact.

Signed _____

Date _____

AGRIQUALITY SAMPLE RECEIPT INFORMATION

AgriQuality Job: Received By:	
Date Received: Date Due:	
Client Manager: Job Manager:	
Phone: Fax:	(04) 570 1555 (04) 560 5573

CLIENT SAMPLE ID	SAMPLE DESCRIPTION/LOCATION/ SITE	SAMPLING DATE	SAMPLE TYPE	TOTAL No. OF BOTTLES	ANALYSIS REQUIRED	AGRIQUALITY SAMPLE NUMBER	COMMENTS

CL_____

Page__of__

Appendix 4

Limits of detection for analyses by AgriQuality

Where these contaminants have been dumped and are leaching into the environment it could be expected that the acid herbicides and the OC pesticides would be present in reasonably high levels - tens to hundreds of parts per billion or higher. We understand the Regional Council, to have assurance that the compounds are either not present or at levels that do not pose risk, requires testing detection limits of at least 1 ppb or better for water samples, and 10 ppb or better for soils.

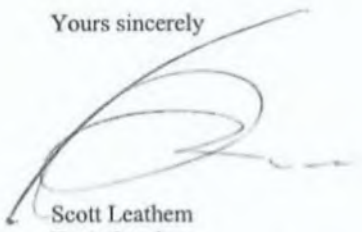
Any dioxins in soil as a result of dumping or leaching would most likely be present in the low ppb range. An approach that would give the Regional Council assurance that dioxins are not a risk would be to assess dioxin levels against an appropriate standard. After consultation with the Ministry for the Environment it has been suggested that the guidelines for the timber treatment industry may be appropriate. These guidelines are set for dioxins in soil at 10 ppt TEQ. Any analytical approach for these compounds will therefore need to achieve detection limits of at least ten times less than this level, that is 1 ppt or better.

AgriQuality Environmental has available various accredited testing methods and capabilities that would support such a testing programme:

- For known contaminated sites, we have an OC pesticide screen that will detect these compounds down to 200 ppb levels in water.
- For uncharacterised sites, we can offer both acid herbicide and OC pesticide screens capable of detecting such compounds down to 0.1 ppb in waters and 1 ppb on soils. Lower detection limits for OC pesticides to 0.01-0.2 ppb levels are also available, should the Council desire this.
- As 2378 TCDD is the major dioxin contaminant in 2,4,5-T, testing for this dioxin, rather than a full dioxin congener suite, could be applied in the first instance. This screen is capable of detecting 2378 TCDD down to 1-10 ppt in soils.
- Where 2378 TCDD is found, and it becomes an issue as to whether or not the source of this dioxin is 2,4,5-T, a full dioxin congener suite could be applied to resolve this issue.

I have appended more detailed information of these tests. This information includes details of our standard pricing but we are willing to negotiate pricing with you. We look forward to the opportunity to work with you on this project and if you have any other questions, please contact me.

Yours sincerely



Scott Leathem
Team Leader
UltraTrace™ Laboratory
AgriQuality Environmental

Appendix: Methodology, Limits of Detection & Standard Pricing

Acid Herbicides

Individual Compounds and Detection Limits (LODs):

Acid Herbicide	Aqueous LOD	Soil LOD
Mecoprop	0.1 µg/L	0.1 mg/kg
MCPA	0.1 µg/L	0.1 mg/kg
Dichlorprop	0.1 µg/L	0.1 mg/kg
2,4-D	0.1 µg/L	0.1 mg/kg
triclopyr	0.1 µg/L	0.1 mg/kg
MCPB	0.1 µg/L	0.1 mg/kg
2,4,5-T	0.1 µg/L	0.1 mg/kg
2,4-DB	0.1 µg/L	0.1 mg/kg
bentazone	0.1 µg/L	0.1 mg/kg
picloram	0.1 µg/L	0.1 mg/kg
fenoprop	0.1 µg/L	0.1 mg/kg

The standard price per sample exclusive of GST is:

Aqueous	$195.00
Soil	$210.00

Organochlorine Pesticides (OCs)

Individual Compounds and Detection Limits:

OC Pesticide	Aqueous (µg/L)	Soil (mg/kg)
Hexachlorobenzene	0.1	0.1
Lindane	0.1	0.1
Heptachlor	0.1	0.1
Aldrin	0.1	0.1
heptachlor epoxide	0.1	0.1
Procymidone	0.2	0.2
α-chlordane	0.1	0.1
pp-DDE	0.1	0.1
Dieldrin	0.1	0.1
pp-DDD	0.1	0.1
pp-DDT	0.2	0.2
Methoxychlor	0.2	0.2
cis permethrin	0.2	0.2
trans permethrin	0.2	0.2
alpha-BHC	0.1	0.1
beta-BHC	0.1	0.1
delta-BHC	0.1	0.1
endosulfan I	0.1	0.1
endosulfan II	0.1	0.1
endosulfan sulfate	0.1	0.1
endrin	0.1	0.1
endrin aldehyde	0.1	0.1
endrin ketone	0.1	0.1

Appendix 5

Analytical protocols in use by AgriQuality

AgriQuality New Zealand Limited
Hua rangi Aotearoa

Gracefield Research Centre
Gracefield Road
PO Box 30 547
Lower Hutt
New Zealand

AgriQuality Environmental
Phone: 64 4 570 8822
Fax: 64 4 569 4500

Email: <allwoodj@agriquality.co.nz>

Facsimile

AgriQuality NEW ZEALAND

To: Gary Bedford — Fax: 06 765 5097

Company: Taranaki Regional Council — Date: May 30, 2001

From: Moana Mackey — Pages (including this page): 1

Gary,

2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) Screen

Limits of detection:

Aqueous samples	0.1-1 ppt
Solid samples	1-10 ppt

Solid samples are analysed according to USEPA Method 8290.
Aqueous samples are analysed according to USEPA Method 1613A.

The holding time for both aqueous and solid samples is one year.

Acid herbicide screen

Aqueous samples are analysed according to APHA 6640.
Soil samples are analysed by an in house method based on APHA 6640.

The holding time for aqueous samples is seven days.
The holding time for soil samples is fourteen days.

Organochlorine pesticides (OCs):

Solid samples are extracted by Soxhlet extraction (USEPA 3540) or pressurised fluid extraction (USEPA3545) or ultrasonication (USEPA 3550).
Aqueous samples are extracted by liquid/liquid extraction (USEPA 3510).

The holding time for both aqueous and soil samples is three months.

I hope this covers everything. Let me know if you require any further information.

Kind regards

Moana Mackey
UltraTrace™ Laboratory
AgriQuality Environmental

HAND DELIVERED 30/5/01
ORIGINAL GIVEN TO Gary B
SENT IN MAIL ON 31/5/01
KB

001

30/05 '01 WED 16:03 FAX

Appendix 6

Site descriptions and sampling strategy

Investigation of Alleged Historical dioxin disposal – Stage two

Stage two of the investigation is commencing and a methodology for processing each site is necessary. In order to achieve this methodology a checklist has been developed so that issues for each site can be considered. After determining each site in relation to the checklist the methods of sampling/investigation will be one or more of the following type:

- Archive inspection (AI)
- Photographic perusal
- GPR
- Detailed physical inspection (DPI)
- Soil sampling
- Leachate sampling
- Surface water sampling
- Stream sediment sampling
- Bank face beneath leachate sampling
- Marine biota sampling

The checklist to decide on the sampling/investigation method and to record an audit trail is as follows:

- Historical site activity
- Current site activity
- Proximity of streams
- Surface soil exposure
- Terrain
- Potential for leachate to water
- Ground water depth
- Proximity of bore water
- Point source area
- Other potential exposure pathways

A- Lawry St site	**Corner of Lawry St and Devon St West**
Historical site activity	Unlicensed dumping area – 1960/70's
Current site activity	Mowed roadside available to public
Terrain	Flat area with 45 degree slope to a stream. Not consolidated. Slope covered with woody plants.
Proximity of streams	Mangoatukutuku Stream to the north-west
Surface soil exposure	In lawn, easily available to public
Potential for leachate to water	Ample potential – needs detailed inspection
Ground water depth	Unknown
Proximity of bore water	Unknown
Point source area	Approximately 10 metres x 5 metres
Other potential exposure pathways	Sediment in stream
Type of investigation	GPR, DPI, soil, leaching, surface water, stream sediment and bank face beneath leachate
B-Seaview Road site	**Corner of Seaview Road and Devon St West**
Historical site activity	Unlicensed dumping area – 1960/70's
Current site activity	Fallow
Terrain	45 degrees slope to a stream
Proximity of streams	Mangoatukutuku Stream to the west
Surface soil exposure	Over grown, difficult for public to access
Potential for leachate to water	Ample potential – needs detailed inspection
Ground water depth	Unknown
Proximity of bore water	Unknown
Point source area	Approximately 10 metres x 10 metres
Other potential exposure pathways	Sediment in stream
Type of investigation	GPR, DPI, soil, leaching, surface water, stream sediment, bank face beneath leachate

C – Pylon 3 site	Centennial Drive
Historical site activity	Pipeline construction, pylon construction, tarsealing and contouring and grassing fro public use – 1960's
Current site activity	Part recreational area
Terrain	Flat in public area. Rolling the remaining
Proximity of streams	Nil. On coast with cliffs to Tasman Sea
Surface soil exposure	Ample in public area
Potential for leachate to water	Yes to the cliffs of the Tasman Sea
Ground water depth	Unknown at this stage
Proximity of bore water	Nil
Point source area	200 metres x 200 metres
Other potential exposure pathways	No
Type of investigation	Photographic perusal, GPR, DPI, soil, leaching, bank face beneath leachate
Ca – Centennial Drive	**Centennial Drive – not being investigated**
Historical site activity	
Current site activity	
Terrain	
Proximity of streams	
Surface soil exposure	
Potential for leachate to water	
Ground water depth	
Proximity of bore water	
Point source area	
Other potential exposure pathways	
Type of investigation	

D – 34 Rangitake Drive	34 Rangitake Drive
Historical site activity	Allegedly received stormwater from IWD premises rior to residential development and alleged dumping area – 1960/70's
Current site activity	Residential
Terrain	Sloping to a stream
Proximity of streams	Unnamed tributary of the Herekawe Stream at the rear western end
Surface soil exposure	Yes
Potential for leachate to water	Yes, requires detailed inspection
Ground water depth	At stream level
Proximity of bore water	Nil
Point source area	¼ Acre
Other potential exposure pathways	Possible illegal dumping area
Type of investigation	Archive inspection, photographic perusal, GPR, DPI, soil, leaching?, surface water, stream sediment, bank face beneath leachate?
E – Omata Reserve	**East of the Methanex Tank farm**
Historical site activity	Alleged drum dumping area (received fill from tank farm construction). Fallow
Current site activity	Fallow, not easily available to public
Terrain	Rolling to steep down to unnamed trib of the Herekawe Stream
Proximity of streams	Unnamed trib of the Herekawe Stream to the east
Surface soil exposure	Minimal
Potential for leachate to water	Yes, requires investigation
Ground water depth	At stream level
Proximity of bore water	Unknown – possible at the tank farm
Point source area	10 metres x 10 metres
Other potential exposure pathways	Nil
Type of investigation	Photographic perusal, GPR, DPI, soil, leaching, surface water, stream sediment, bank face beneath leachate

F – IWD/1 site	On the Dow AgroSciences land – company will investigate
Historical site activity	
Current site activity	
Terrain	
Proximity of streams	
Surface soil exposure	
Potential for leachate to water	
Ground water depth	
Proximity of bore water	
Point source area	
Other potential exposure pathways	
Type of investigation	GPR
G – Marfell Park	**Marfell Park, Omata Road**
Historical site activity	Licensed landfill – 1960's
Current site activity	Playing fields
Terrain	Flat, sloping bank 45 metres to a stream on north-eastern side
Proximity of streams	Small stream to a wetland on north-eastern side
Surface soil exposure	Yes, recreational
Potential for leachate to water	Yes, needs detailed inspection
Ground water depth	At stream level
Proximity of bore water	Nil
Point source area	5 metres x 5 metres, a specific point
Other potential exposure pathways	Sediment
Type of investigation	Archive inspection, photographic perusal, DPI, leaching, surface water, stream sediment, bank face beneath leachate,

H – Ngamotu Domain	Ngamotu Domian, Pioneer Road
Historical site activity	Licensed landfill
Current site activity	Playing fields
Terrain	Flat, sloping bank 45 metres to a stream on north-eastern side
Proximity of streams	Small stream to a wetland on north-eastern side
Surface soil exposure	Yes, recreational
Potential for leachate to water	Yes, needs detailed inspection
Ground water depth	At stream level
Proximity of bore water	Nil
Point source area	5 metres x 15 metres, identified as a specific point
Other potential exposure pathways	Sediment
Type of investigation	Archive inspection, photographic perusal, DPI, leaching, surface water, stream sediment, bank face beneath leachate
I – 7A Squire Place	**7A Squire Place**
Historical site activity	Fallow – 1960's
Current site activity	Residential
Terrain	Gentle bank slope to stream
Proximity of streams	Small stream on the eastern side
Surface soil exposure	Minimal
Potential for leachate to water	Yes
Ground water depth	Unknown
Proximity of bore water	Unknown
Point source area	200 metres x 5 metres
Other potential exposure pathways	Sediment in stream area
Type of investigation	Archive inspection, leaching, surface water, stream sediment, bank face beneath leachate

J – Belt Road	At the end of Belt Road, to the east
Historical site activity	Fallow, dump area for sludge from sewerage cleaning – 1960's
Current site activity	Part mowed area available to public
Terrain	Flat and cliff site
Proximity of streams	Nil, includes the cliff to the Tasman Sea
Surface soil exposure	Been grassed in one area and possible
Potential for leachate to water	Negligible
Ground water depth	Unknown
Proximity of bore water	Nil
Point source area	50 metres x 50 metres
Other potential exposure pathways	Nil
Type of investigation	DPI, soil
K – Victoria Road	**Victoria Road, Oakura**
Historical site activity	Farming, gorse covered area – 1960's
Current site activity	Farming
Terrain	45 degree slope
Proximity of streams	Wetlands 200 metres away
Surface soil exposure	Area since been turned over and grassed into good grazing land
Potential for leachate to water	Nil, too historical
Ground water depth	3 metres
Proximity of bore water	Nil
Point source area	200 metres x 50 metres
Other potential exposure pathways	Nil
Type of investigation	No further investigation

L – 23C Tahurangi Plc	23C Tahurangi Place
Historical site activity	Alleged stormwater discharge off IWD site – 1970's
Current site activity	Residential
Terrain	Gentle rolling
Proximity of streams	No stream nearby
Surface soil exposure	Gardens and residential
Potential for leachate to water	Minimal
Ground water depth	Unknown
Proximity of bore water	Nil
Point source area	¼ Acre
Other potential exposure pathways	Nil
Type of investigation	Archive inspection, Soil
M – Beach Road/1	**At the end of Beach Road to the west**
Historical site activity	Farming and possible Ngahoro site, the subject of alleged full drum on pallets dumping – 1960's
Current site activity	Farming
Terrain	Hilly
Proximity of streams	Unnamed small stream to the Tasman Sea on north-eastern side
Surface soil exposure	Nil
Potential for leachate to water	Possible
Ground water depth	Stream level
Proximity of bore water	Unknown
Point source area	20 metres x 20 metres
Other potential exposure pathways	Minimal chance
Type of investigation	GPR, surface water

N - Waireka	Waireka Road, Omata - company will investigate
Historical site activity	
Current site activity	
Terrain	
Proximity of streams	
Surface soil exposure	
Potential for leachate to water	
Ground water depth	
Proximity of bore water	
Point source area	
Other potential exposure pathways	
Type of investigation	Marine biota
O – Pioneer Road	**No further action, used as a name for Ngamotu Domain**
Historical site activity	
Current site activity	
Terrain	
Proximity of streams	
Surface soil exposure	
Potential for leachate to water	
Ground water depth	
Proximity of bore water	
Point source area	
Other potential exposure pathways	
Type of investigation	

P – 26A Rangitake Dv	26A Rangitake Drive
Historical site activity	Allegedly received stormwater from IWD premises rior to residential development also alleged drum dump area – 1970's
Current site activity	Residential
Terrain	Sloping to a stream
Proximity of streams	Unnamed tributary of the Herekawe Stream at the rear western end
Surface soil exposure	Yes
Potential for leachate to water	Yes, requires detailed inspection
Ground water depth	At stream level
Proximity of bore water	Nil
Point source area	¼ Acre
Other potential exposure pathways	Possible illegal dumping area
Type of investigation	Archive inspection, GPR, DPI, soil
Q – Rifle Range Road/Bewley Road	**Next to the Waiwhakaiho River, Waiwhakaiho**
Historical site activity	Site of the former Taranaki County Council licensed landfill. Known contaminated site. 1970's
Current site activity	Heavy industrial
Terrain	Flat and banked to the river
Proximity of streams	Waiwhakaiho River northern end
Surface soil exposure	Minimal – heavy industry covers most of the site
Potential for leachate to water	Yes, detailed inspection required
Ground water depth	River level
Proximity of bore water	Unknown
Point source area	Not specifically sourced
Other potential exposure pathways	Nil, other than leachate possibilities
Type of investigation	Archive inspection, DPI, leachate sampling

R – Beach Road	**Beach Road**
Historical site activity	Former IWD dairy farm, identified by T.V. camera presence during removal of previous dumpsite – 1960's
Current site activity	Farming
Terrain	Flat
Proximity of streams	Nil, 750 metres near Tasman Sea
Surface soil exposure	Nil
Potential for leachate to water	Minimal
Ground water depth	Unknown
Proximity of bore water	Unknown
Point source area	20 metres x 20 metres
Other potential exposure pathways	Nil
Type of investigation	GPR, soil
T – Colson Road Landfill	**Colson Road, already monitored, no action on this site**
Historical site activity	
Current site activity	
Terrain	
Proximity of streams	
Surface soil exposure	
Potential for leachate to water	
Ground water depth	
Proximity of bore water	
Point source area	
Other potential exposure pathways	
Type of investigation	

U – IWD/2	On the Dow AgroSciences land – company will investigate
Historical site activity	
Current site activity	
Terrain	
Proximity of streams	
Surface soil exposure	
Potential for leachate to water	
Ground water depth	
Proximity of bore water	
Point source area	
Other potential exposure pathways	
Type of investigation	GPR
V – Centennial/2	**Centennial Drive**
Historical site activity	Former discharge point for the now unused stormwater system from the office area of IWD – 1960's
Current site activity	Nil, the pipe is still evident.
Terrain	At the base of the cliffs to the west of Paritutu
Proximity of streams	Possible small stream nearby, base of cliff by Tasman Sea
Surface soil exposure	Possible below outlet pipe
Potential for leachate to water	No
Ground water depth	Not relevant
Proximity of bore water	No
Point source area	The Tasman Sea
Other potential exposure pathways	Possible leachate
Type of investigation	Photographic perusal, DPI, soil

W – Herekawe Stream	Herekawe Stream
Historical site activity	Receives batch discharge water from IWD plant since late 1980's
Current site activity	Recreational Stream
Terrain	Flat sandy. There is not a reef off this stream
Proximity of streams	-
Surface soil exposure	Nil
Potential for leachate to water	Nil
Ground water depth	Not relvant
Proximity of bore water	Nil
Point source area	The stream
Other potential exposure pathways	The Tasman Sea
Type of investigation	Possible marine biota sampling
X – Roto Street	**Off Roto Street**
Historical site activity	Nursery. Alleged drum dump area – 1970's
Current site activity	Residential
Terrain	Flat
Proximity of streams	Leachate goes to a surface drain and to a pump station, which is pumped to the Mangaotukutuku Stream
Surface soil exposure	Possible
Potential for leachate to water	Yes
Ground water depth	Unknown
Proximity of bore water	Unknown
Point source area	40 metres x 20 metres
Other potential exposure pathways	minimal
Type of investigation	Photographic perusal, GPR, DPI, soil, leaching?, surface water, stream sediment, bank face beneath leachate?

Z – Ngahoro	End of Beach Road/Centennial Drive
Historical site activity	Farming. The original Ngahoro site that was removed to IWD factory and contaminated soil to Waireka – 1960's
Current site activity	Farming
Terrain	Generally flat
Proximity of streams	Nil
Surface soil exposure	Minimal
Potential for leachate to water	Nil
Ground water depth	Unknown
Proximity of bore water	Nil
Point source area	20 metres x 20 metres
Other potential exposure pathways	nil
Type of investigation	GPR, Soil
Za - 60 marama Cres	**60 Marama Crescent**
Historical site activity	Farming. Drum part alleged to have been found.
Current site activity	Residential
Terrain	Gentle rolling
Proximity of streams	Minimal
Surface soil exposure	Minimal
Potential for leachate to water	Nil
Ground water depth	Unknown
Proximity of bore water	Nil
Point source area	¼ Acre
Other potential exposure pathways	nil
Type of investigation	Archive inspection, GPR, soil

Zb – Buller Street	Buller Street
Historical site activity	Site of the original Ivon Watkins factory – 1950's
Current site activity	Commerce
Terrain	Flat
Proximity of streams	Nil
Surface soil exposure	Covered by offices
Potential for leachate to water	Leaching to the Tasman Sea
Ground water depth	Unknown
Proximity of bore water	Nil
Point source area	Unknown
Other potential exposure pathways	Nil
Type of investigation	Archive inspection, DPI, marine sampling in conjunction with Elliott St
Zc – Tarahua Road	**Tarahua Road**
Historical site activity	Warehouse – used by the original Ivon Watkins Limited – covered by building concrete or gravel – 1950's
Current site activity	Sales venue
Terrain	flat
Proximity of streams	Nil
Surface soil exposure	Nil
Potential for leachate to water	Nil
Ground water depth	Nil
Proximity of bore water	Unknown
Point source area	0.5 hectare
Other potential exposure pathways	nil
Type of investigation	No investigation at this site

Zd – Tasman Sea	**Tasman Sea**
Historical site activity	Recreation – 1960 on
Current site activity	Recreation
Terrain	Water
Proximity of streams	Receives coastal streams
Surface soil exposure	Nil
Potential for leachate to water	Yes
Ground water depth	Not applicable
Proximity of bore water	Nil
Point source area	5 point sources from receiving areas - Elliott St, Belt Road, Paritutu Rock, Herekawe Stream and Waireka dumpsites
Other potential exposure pathways	Nil
Type of investigation	Marine biota
Ze – Tank 3500	**Off the tank farm road, Centennial Drive**
Historical site activity	Former IWD dairy farm, identified by former engineer Steve Tooley – 1960's
Current site activity	Farming
Terrain	Flat
Proximity of streams	Nil, 250 metres near Tasman Sea
Surface soil exposure	Nil
Potential for leachate to water	Minimal
Ground water depth	Unknown
Proximity of bore water	Unknown
Point source area	20 metres x 20 metres
Other potential exposure pathways	Nil
Type of investigation	GPR

Zf – IWD/3	On the Dow AgroSciences land – company will investigate
Historical site activity	
Current site activity	
Terrain	
Proximity of streams	
Surface soil exposure	
Potential for leachate to water	
Ground water depth	
Proximity of bore water	
Point source area	
Other potential exposure pathways	
Type of investigation	GPR
Zg – IWD/4	**On the Dow AgroSciences land – company will investigate**
Historical site activity	
Current site activity	
Terrain	
Proximity of streams	
Surface soil exposure	
Potential for leachate to water	
Ground water depth	
Proximity of bore water	
Point source area	
Other potential exposure pathways	
Type of investigation	GPR

Zh – Car Park	**Centennial Drive, near the car park west of the Herekawe Str**
Historical site activity	Fallow. Has been the subject of sampling before (iron) – 1960's
Current site activity	Fallow
Terrain	Cliff face adjacent to Tasman Sea
Proximity of streams	Not relevant
Surface soil exposure	Not relevant, except for below the leaching discharge point
Potential for leachate to water	This is the reason for inclusion – leaching from cliff
Ground water depth	At source
Proximity of bore water	Nil
Point source area	1 metre x 1 metre
Other potential exposure pathways	Tasman Sea
Type of investigation	Photographic perusal, DPI, leaching, bank face beneath leachate,
Zi – Herekawe cliff	**Centennial Drive, east of the Herekawe Stream and off the mowed area near the corner of Rangitake Street (off Sartens)**
Historical site activity	Fallow, alleged drum dumping area – 1960's
Current site activity	Fallow
Terrain	Rolling
Proximity of streams	Not relevant
Surface soil exposure	Minimal
Potential for leachate to water	Possible ground water
Ground water depth	Unknown, except for known leachate discharge depth on the cliff face to the Tasman Sea
Proximity of bore water	Nil
Point source area	100 metres x 50 metres plus 1 metre x 1 metre at cliff face
Other potential exposure pathways	nil
Type of investigation	DPI, leaching, bank face beneath leachate, marine biota (in Zd)

Zk – Jury site	At the end of Norwich Avenue
Historical site activity	Farming – known concrete bunker site – 1950's
Current site activity	Fallow
Terrain	Rolling
Proximity of streams	Nil
Surface soil exposure	Possible
Potential for leachate to water	Minimal
Ground water depth	Unknown
Proximity of bore water	Nil
Point source area	5 metres x 5 metres, pieces of concrete are still visible
Other potential exposure pathways	nil
Type of investigation	GPR, DPI, soil,

Sites Table: Sampling and reasons

		Archive inspection	Photographic perusal	GPR	DPI	Soil	Leaching	Surface Water	Stream Sediment	Bank face beneath leachate	Marine biota	
A	Lawry Street site - GPS 2600700E-6237180N. On the corner of Lawry Street and Devon Street West, and west of the garden centre on Devon Street West. The site is on the western bank of the Mangaotukutuku Stream. **Proposed inspection/sampling method** – GPR, water and soil samples			*	*	*	*	*	*	*		
B	Seaview Road site - GPS 2600656E-6237096N. This alleged site is on the corner of Seaview Road and Devon Street West, behind the Shell service station and across from site-A. There are doubts about this site as no person has positively stated that wastes were dumped there. The site is on the eastern bank of the Mangaotukutuku Stream. **Proposed inspection/sampling method** – GPR, water and soil samples			*	*	*	*	*	*	*		
C	Pylon 3 site - GPS2598377E-6237586N. The alleged site is immediately north/west of the IWD premises and is on both sides of Centennial Drive and includes an area approximately 100m x 150m in the Parituta Centennial Park. The pipeline corridor transverses part of the site. There is an alleged discharge emanating from the cliffs below this site. **Proposed inspection/sampling method** – GPR, water and soil samples		*	*	*	*	*			*		

Ca	Centennial Drive site - GPS25985535E-6237713N. This alleged site was addressed as part of the Council's dieldrin investigation in 1991 and is not under consideration for this investigation. **Proposed inspection/sampling method** – nil															
D	34 Rangitake Drive - GPS2598513E-6236679N. The alleged site is at the rear of the property at 34 Rangitake Drive. Prior to residential development this site was above a small tributary of the Herekawe Stream that allegedly received stormwater from the IWD premises. At least three previous owners identified the site. Alleged burial **Proposed inspection/sampling method** – GPR, water and soil samples	*	*	*	*	*	*	?	*	*	*	?				
E	Omata Reserve (east of the Methanex tank farm) - GPS2598382E-6236657N. The alleged site is on New Plymouth District Council reserve land on the eastern side of the Methanex tank farm. It has been planted by the New Plymouth District Council in previous years. The site was identified by Andrew Gibbs, previous occupiers do not support the allegations. **Proposed inspection/sampling method** – GPR, water and soil samples		*	*	*	*	*	*	*	*	*	*				
F	IWD 1 site - GPS2598663E-6237173N. An alleged disposal site on the IWD premises. This site will be investigated following discussions with DowAgroSciences. **Proposed inspection/sampling method** – To be confirmed			*												

G	Marfell Park - GPS2600682E-6236037N (identified by Andrew Gibbs and Ian McLeod), GPS2600734E-6236179N (identified by Trevor Fleming). This site was a known municipal landfill prior to being closed, grassed and used as playing fields in the late 1970's. Dumping of 200 litre drums is alleged. The Mangaolukutuku Stream is close by. Also wastes from the unblocking of the City sewerage system at the corner of Ngamotu Road and Centennial Drive were disposed of here. The wastes were identified as being phenol based. **Proposed inspection/sampling method** – Water samples	*	*		*			*		*	*	*			
H	Ngamotu Domain - GPS2599875E-6237183N. This site is also a known past municipal landfill. The site has also been covered, grassed and is used as playing fields. Wastes from the unblocking of a city sewerage were disposed of at this site. **Proposed inspection/sampling method** – Water sampling	*	*		*			*		*	*	*			
I	7A Squire Place – GPS2600021E-6337111N. A stormwater pipe that allegedly could have contained leachate from the Ngamotu Domain landfill discharges at this location. **Proposed inspection/sampling method** – Water and soil samples	*						*		*	*	*			
J	Belt Road – GPS260143E-6238019N. This site is at the end of Belt Road (over the railway line to the right) on the coast. This is another site where wastes from the unblocking of city sewerage was disposed of. The wastes allegedly flowed over the cliffs and into the sea. Identified by Andrew Gibbs, Trevor Humphries and Paddy Burt. **Proposed inspection/sampling method** – Soil samples and marine sampling					*	*								
K	Victoria Road, Oakura – GPS2593182E-6232055N. This site is the first farmlet up Victoria Road off SH45. No further action is envisaged on this site. **Proposed inspection/sampling method** – nil														

L	23C Tahurangi – GPS2598732E-6236974N. This is a residential site on Tahurangi Place. Prior to residential development it is alleged a stormwater pipe used to discharge from the IWD premises onto farm land where this property is situated. **Proposed inspection/sampling method** – Soil samples	*				*						
M	Beach Road-1 – GPS2597532E-6235427N. This alleged site is at the end of Beach Road to the west and has been linked with the known and rehabilitated Ngahoro dump. A small spring is nearby. **Proposed inspection/sampling method** – GPR and water samples			*				*				
N	Waireka – GPS2596874E6234237N. This records the identification by a number of interviewees if the known rehabilitated dump sites (2) at Waireka. No further action is proposed on these sites. The sites are the subject of ongoing monitoring since 1986. **Proposed inspection/sampling method** – nil										*	
O	Pioneer Road – GPS2599214E-6237257N. Further investigation showed this site was the road leading to the Ngamotu Domian, then a landfill site. **Proposed inspection/sampling method** – nil											
P	26A Rangitake Drive – GPS2598481E-6236717N. This alleged site is at the rear of a residential property at 26A Rangitake Drive. Prior to residential development this alleged site was adjacent to a small tributary of the Herekawe Stream that may have received stormwater from the IWD premises. **Proposed inspection/sampling method** – GPR, water and soil samples	*		*	*	*	Already done at site D					

Q	Rifle Range Road/Bewley Road – GPS2606429E-6239250N. This alleged site is located on Rifle Range Road next to the Waiwhakaiho River. Part of the developed area was a Taranaki County Council dump. The old landfill site has resource consents and is monitored. **Proposed inspection/sampling method** – One water sample (dioxin) in conjunction with site-Y	*			*		*					Dioxin, O/C's. Already done other tests eg; PCP's
R	Beach Road – GPS2598038E-6235117N. This alleged site is on the old IWD dairy farm on Beach Road approximately 750 metres from the sea and was identified by Sam Lowe during the extraction of chemicals from old dumpsites during the early 1980's. **Proposed inspection/sampling method** – GPR and soil samples.			*		*						
T	Colson Road Landfill – GPS2607397E-6237616N. This is a present municipal landfill and has been in use since the early 1970's. It is alleged that IWD waste products have been disposed of in this landfill during past years. This landfill has resource consents and is monitored. **Proposed inspection/sampling method** – One water sample (dioxin)		Nil – NPDC already done dioxin on leachate									
U	IWD/2 - Another alleged dumpsite on the IWD premises that will be investigated following discussions with Dow AgroSciences. The allegation refers to a concrete bunker used as an anisol storage facility. **Proposed inspection/sampling method** – To be confirmed				*							
V	Centennial/2 – GPS2598524E-6237853N. This alleged site is the discharge point of the former stormwater line from the office blocks of the IWD premises. The stormwater system was apparently accessed during spills that occurred on site and was seen to be frothing before the mid 1980's. **Proposed inspection/sampling method** – Soil sample and marine survey (refer Zd)		*		*	*						

W	Herekawe Stream – GPS2598309E-6236771N. This is the current stormwater discharge from the IWD premises. The discharge has resource consents and is monitored. **Proposed inspection/sampling method** – Water sample and marine sample (refer Zd)		See site D									
X	Roto Street – GPS2600775E-6234738N. This alleged site is located on a recent subdivision. The land was previously owned by Duncan and Davies Nurseries, Westown. The allegation is that drums containing chemical had been dumped. A drain flows from the south-west end of the subdivision. **Proposed inspection/sampling method** – GPR, water and soil samples	*	*	*	*	*	?	*	*	?		
Z	Ngahoro – GPS2597661E-6235515N. This is a known site on the old IWD dairy farm. In February 1981, 230 drums of waste were removed from this site and returned to Ivon Watkins-IWD Ltd for incineration or recycling. About 1000m^2 of soil was relocated from this site to the Waireka facility. It has been alleged that between thirty and fifty empty drums and assorted rubbish were left behind and covered with 1.5 to 3 metres of clean soil however, the company has stated that all wastes were removed from the site. This site will be investigated to confirm clean-up was completed in 1985. **Proposed inspection/sampling method** – GPR, water and soil samples			*		*						
Za	60 Marama Crescent – GPS2598529E-6236990N. This site is located at the rear of a residential property at 60 Marama Crescent. Recently part of a drum was dug up. The site was identified by the current owner. **Proposed inspection/sampling method** – GPR and soil samples	*		*		*						
Zb	Buller Street – GPS2603497E-6238487N. The site of the original Ivon Watkins Limited. **Proposed inspection/sampling method** – nil	*			*							

Zc Tarahua Road - GPS2604173E-6235524N. This is a former warehouse of the original Ivon Watkins Ltd. The site is either sealed, metalled or concreted and was referred by the present owners. No further action is warranted on this site. **Proposed inspection/sampling method** – nil											
Zd Tasman Sea – The Tasman Sea has been the concern of surfers and warrants marine surveys at a number of sites, they are: I Adjacent to Waireka dumpsites II Adjacent to the Herekawe Stream III Adjacent to Paritutu Rock IV Adjacent to Belt Road V Adjacent to Eliot Street **Proposed inspection/sampling method** – marine sampling										* * * * *	At Waireka: TCDD, acid herbicides at Eliot St: O/C's, TCDD (near Buller St site, in use at time) All other sites: TCDD only Two for control site: TCDD, acid herbicides, O/C's benzopyrene (PAHs)
Ze Tank 3500 – GPS2597888E-6235965N. This is a known site on the old IWD dairy farm that has been confused with Ngahoro but is separate. The site was discovered by the then Ministry of Works during the construction of tanks at the tank farm in April/May 1985. IWD were advised and clean-up was undertaken. This site will be investigated to confirm clean-up in 9185. **Proposed inspection/sampling method** – GPR			*								
Zf IWD-3 - Another alleged dumpsite on the IWD premises that will be investigated following discussions with Dow AgroSciences. The allegation refers to dumping of waste in a deep bunker. Identified by Maurice Vickers. **Proposed inspection/sampling method** – To be confirmed			*								
Zg IWD/4 - Another alleged dumpsite on the IWD premises that will be investigated following discussions with Dow AgroSciences. The allegation refers to drums punctuated by shots near the current incinerator. Identified by various parties. **Proposed inspection/sampling method** – To be confirmed			*								

Zh	Car Park – GPS2597919E-6236297N. This alleged site is near the car park west of the Herekawe Stream on a walking track to the beach and is often referred to Council as a chemical discharge and needs to be included for completeness in this investigation. **Proposed inspection/sampling method** – Water sample		*		*		*			*	In Zd	
Zi	Herekawe cliff site – GPS2598205E-6237049N. This alleged site is to the east of the Herekawe Stream and is a cliff discharge that is seen by surfers. It is also refereed to as a chemical discharge and will be sampled for completeness. **Proposed inspection/sampling method** – Water sample				*		*			*	In Zd	
Zk	Jury site – GPS2598766E-6236388N. This alleged site is at the end of Norwich Avenue and was originally a concrete bunker site on the former Jury farm in close proximity to the old Ngamotu Tavern. Old concrete is still visible. There is no waterbody nearby. **Proposed inspection/sampling method** – Soil samples			*	*	*						

Appendix IV

GPR report

Geophysical Survey to investigate Alleged Agrichemical Wastes Storage and Disposal sites.

New Plymouth
August 2001

Report Prepared for
Taranaki Regional Council

By

GPR Geotechnical Services

Introduction

Geophysical investigative surveys were commissioned by the Taranaki Regional Council to be carried out at a total of 19 sites in the New Plymouth environs. The surveys were a component of a suite of investigative techniques utilized by the Council to assess a number of sites.

The purpose of these surveys was to carry out non-intrusive investigations to determine the possible presence of buried drums or similar containers in the designated search areas.

The geophysical surveys carried out utilised Ground Penetrating Radar (GPR) and Electromagnetic Induction (EM) techniques to obtain sub-surface information.

The surveys were carried out during the period 14th May 2001 to 21st June 2001.

Surveys were conducted with a staff member of the Council and either one or two representatives of the Local Dioxin Investigation Action Group in attendance.

Each locality investigated was scanned with GPR to obtain an effective, practical and economical search of the designated site. When considered potentially useful an EM survey was also carried out at sites in order to provide further information on soil electrical properties which may have been affected by buried objects or contamination.

A drawing has been produced for each location investigated to show the location and extent of the survey carried out. Sub-metre Global Positioning System (GPS) location way points (WP) were also collected where considered prudent to accurately record survey site locations.

This report gives an overview of the geophysical surveys carried out, a summary of the resultant data with a conclusion for each investigated site. Each location has been described and reported on separately and in sequence to form the body of this report. Also included are "thumbnail" annotated radargrams showing typical GPR data results obtained for each site.

EM data collected at the Tank 3500 site off Centennial Drive have been included in the appropriate section of this report.

Appendix A of this report lists the GPS way point details.

Geophysical Equipment

A GSSI SIR System-2 Ground Penetrating Radar Control unit together with a 200MHz antenna was used for the GPR survey. The GPR antenna consists of a transmitter that sends out pulses of electromagnetic energy and a receiver that detects the return signal reflected from boundaries where adjacent materials have contrasting dielectric properties.

Signals returned to the antenna are displayed on a screen in real time and stored on a hard drive for subsequent processing and interpretation. Anomalies on the radar file record (radargram) can indicate voids, stratigraphic changes, buried objects, services, changes in water content, etc.

Data collected with GPR is downloaded onto a PC for processing using software called RADAN and an interpretation of resultant data made.

A Geonics EM 31 (Electromagnetic Induction) instrument was used to obtain information on changes in the electrical properties of the soil. The EM 31 consists of a transmitter which generates a high frequency magnetic field and a receiver which detects the generated magnetic field and compares this field to the field created by eddy-currents circulated in the ground. A data logger records the quadrature response which is proportional to the electrical conductivity of the soil as well as the in-phase response which is proportional to the magnetic field strength.

Data collected with the EM 31 is downloaded onto a PC and processed using specialised 3D software to produce an overall result for the site surveyed.

Original data and records for all work and findings presented here are held by GPR Geotechnical Services.

SUMMARY

Two thirds of the locations investigated showed no significant anomalies which might indicate the presence of burial pits containing drums or other containers.

At seven sites investigated, anomalies were detected, ranging from evidence of a pit containing large buried objects at one site, to evidence of a few large buried objects. Further investigation would be required in order to determine the nature of these detected buried objects and/or anomalies.

LOCATIONS INVESTIGATED

Locations investigated continued....

TRC Site A – Lawry/Devon Streets.

Location:

This site is situated on the corner of Devon Street West and Lawry Street known as Westwill Corner. It consists of an open grassed area between Lawry Street and the Peak Plants Garden Centre.

GPR Survey:

GPR scan lines were run in a South to North direction perpendicular to Devon Street. Refer Fig. 1a. Lines were at a spacing of approximately five metres to cover the whole site from Lawry Street to the Peak Plants Garden Centre western boundary fence. GPR radargram file references are Files 78 through to 89. Two GPS positions were captured to record the extent of this survey. These are way points (WP)1 and WP 2.

Data Results:

GPR data showed scattered diffractions indicating that the majority of the area scanned consists of fill material. This result is typical of a general landfill area. Refer Fig 1b.

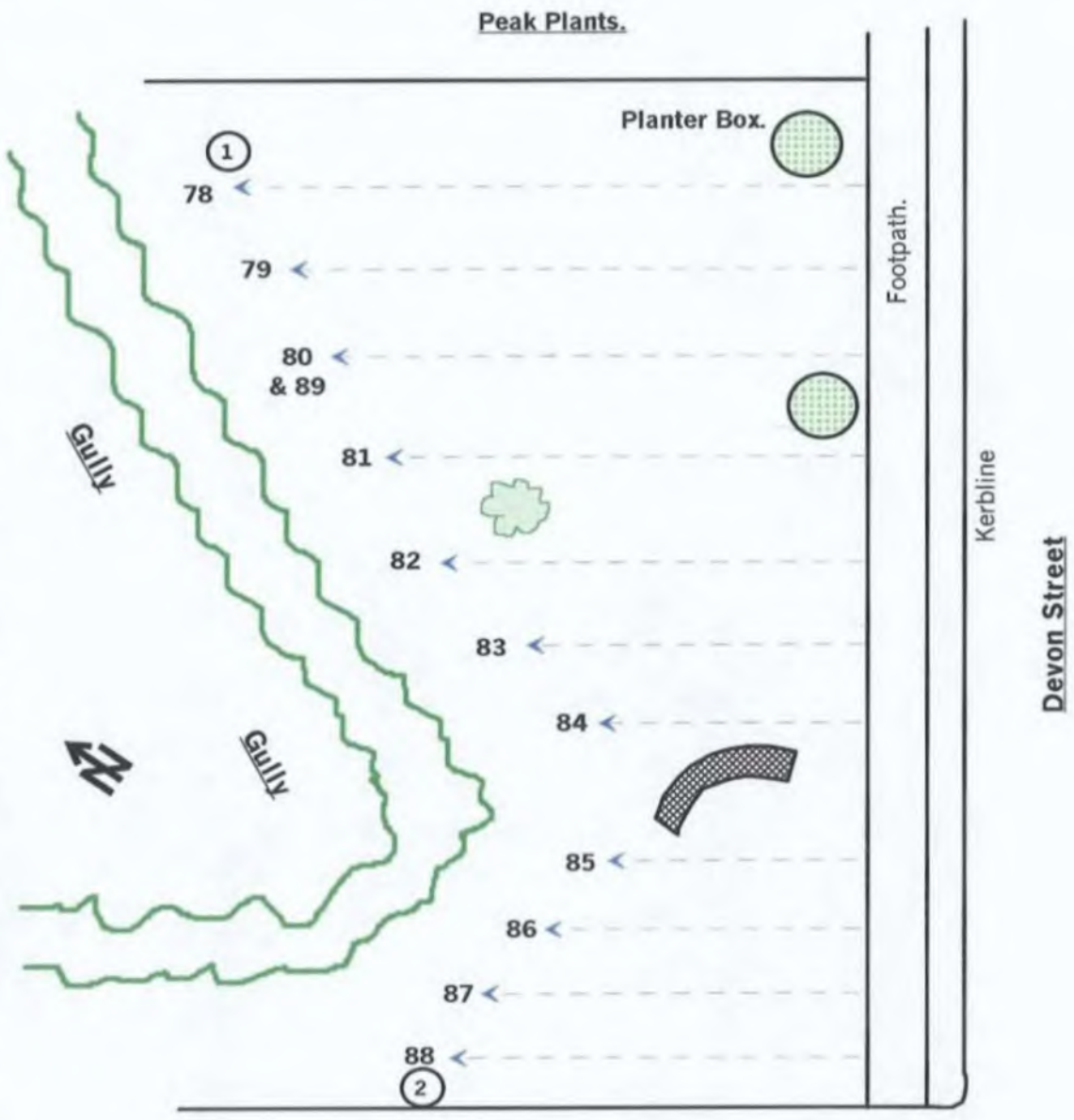
File 81 and File 84 show evidence of landfill with buried debris. The original soil slope to the gully at the north end of this site can also be seen on these files.

File 87 at the western edge of the site shows what is apparently an original soil slope from Devon Street with fill material above.

Conclusions:

All of the data collected from this site did not show evidence of a drum burial site.

TARANAKI REGIONAL COUNCIL
Ground Penetrating Radar Survey.
Lawry / Devon Streets - Site A.
May 2001

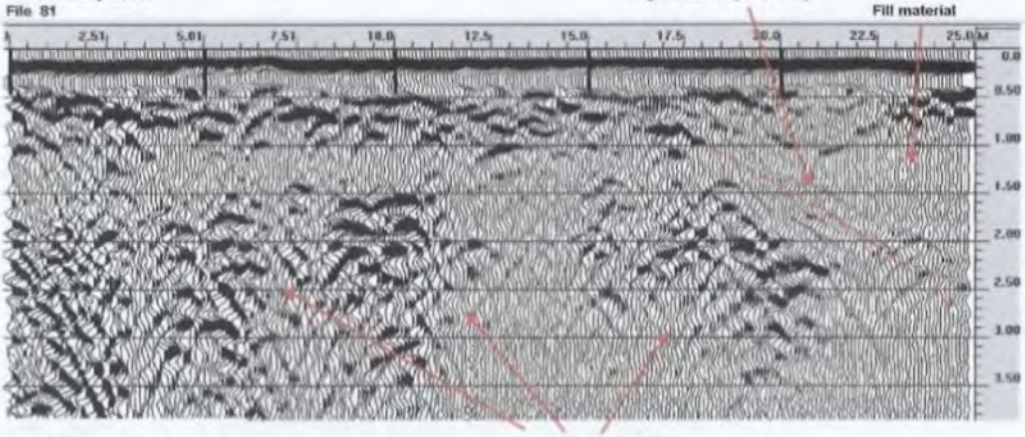


Radar Scan lines at 5 metre (approx) spacing.

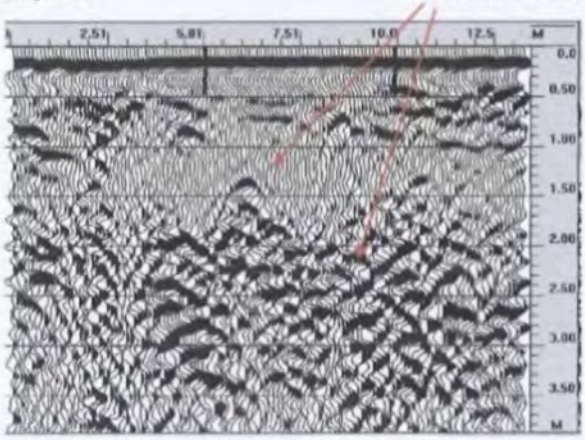
Figure 1a

LAWRY STREET SITE

Site A - Lawry Street
File 81



Site A - Lawry Street
File 84



Site A - Lawry Street
File 87

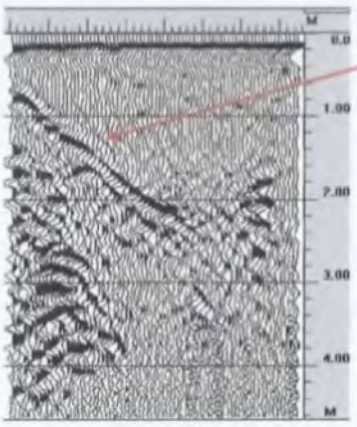


Figure 1b

TRC Site B – Seaview Road

Location:

This site is situated on the corner of Devon Street West and Seaview Road. It consists of an area directly behind and to the north-west of the Shell Service Station adjacent to the creek.

GPR Survey:

GPR scan lines were taken in various directions to cover the area between the service station and the spray paint workshop directly behind it. Refer Fig. 2a. There was a limited amount of space on this site for a GPR survey. GPR radargram file references are File 90 through to 93.

Two GPS positions were captured to record the extent of this survey. These are WP 3 and WP 4.

Data Results:

GPR data collected from this site showed normal soil strata which indicated the likely original soil slope to the creek. The remainder of the site showed small scattered diffractions consistent with fill material. This result is typical of a general landfill area. Refer Fig 2b.

File 91 and File 93 show evidence of the original soil slope down towards the creek.

Conclusions:

All of the data collected from this site did not show evidence of a drum burial site

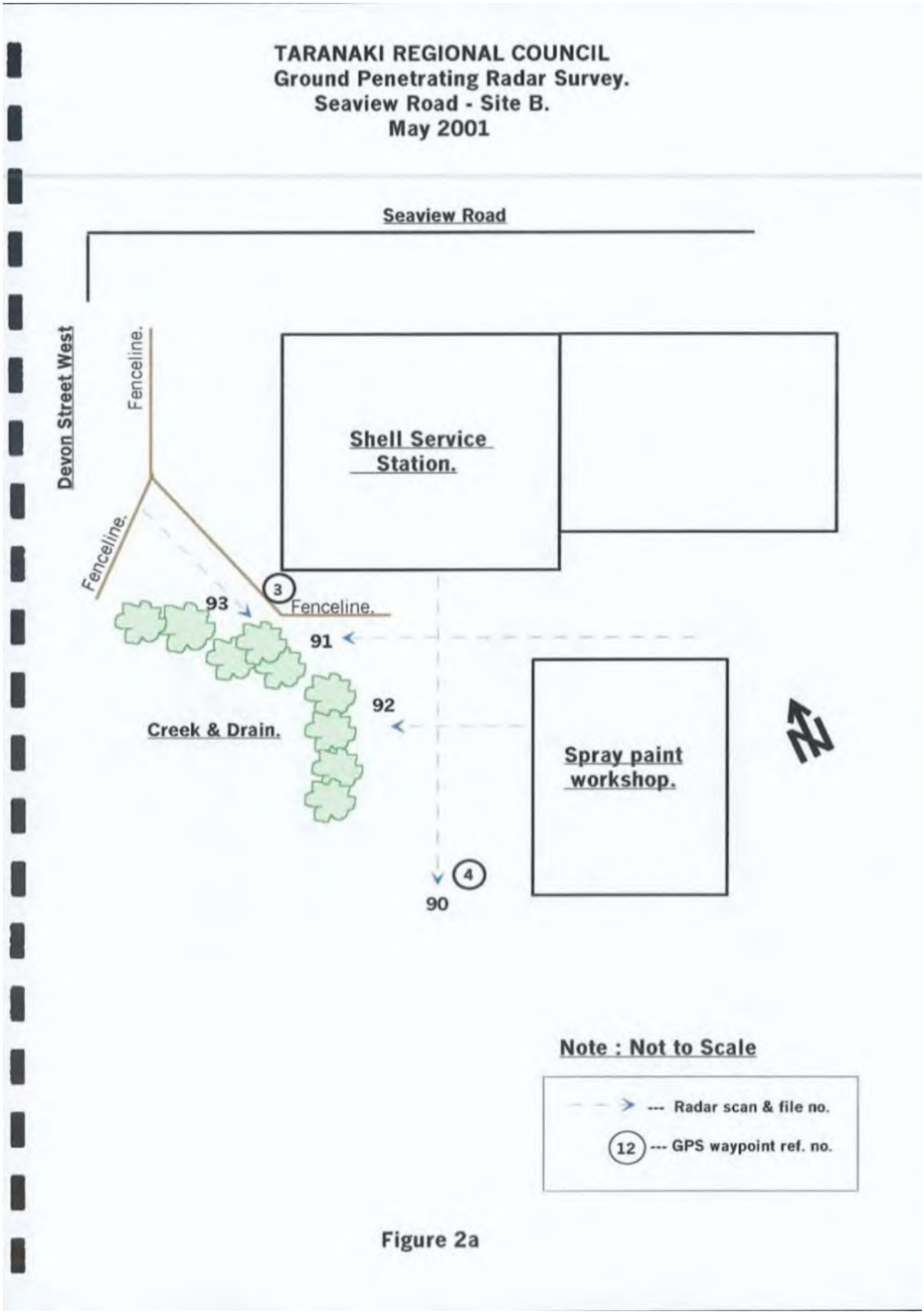
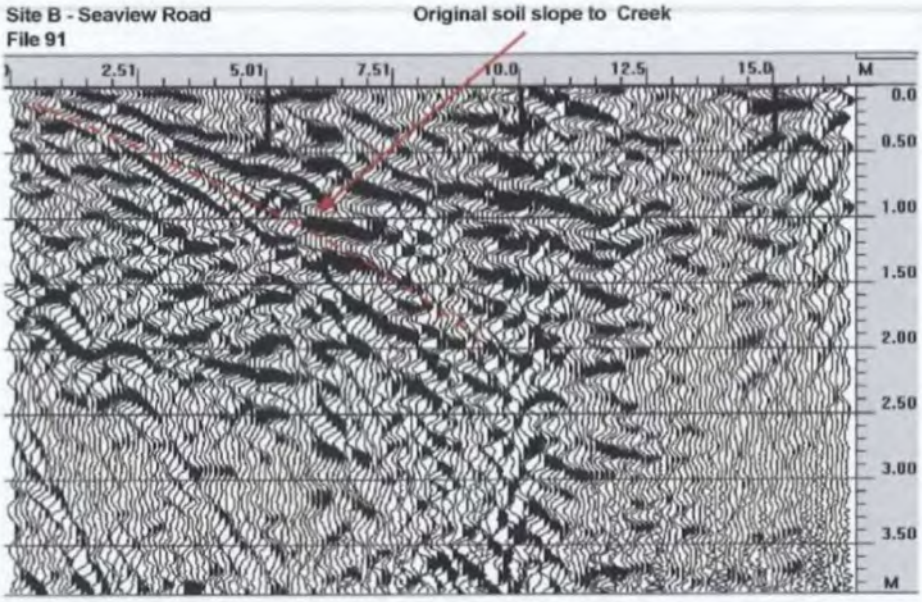

TARANAKI REGIONAL COUNCIL
Ground Penetrating Radar Survey.
Seaview Road - Site B.
May 2001
Seaview Road
Devon Street West
Fenceline.
Fenceline.
Shell Service Station.
3
Fenceline.
93
91
92
Creek & Drain.
Spray paint workshop.
4
90
N
Note : Not to Scale
--- Radar scan & file no.
12 --- GPS waypoint ref. no.

Figure 2a

SEAVIEW ROAD SITE



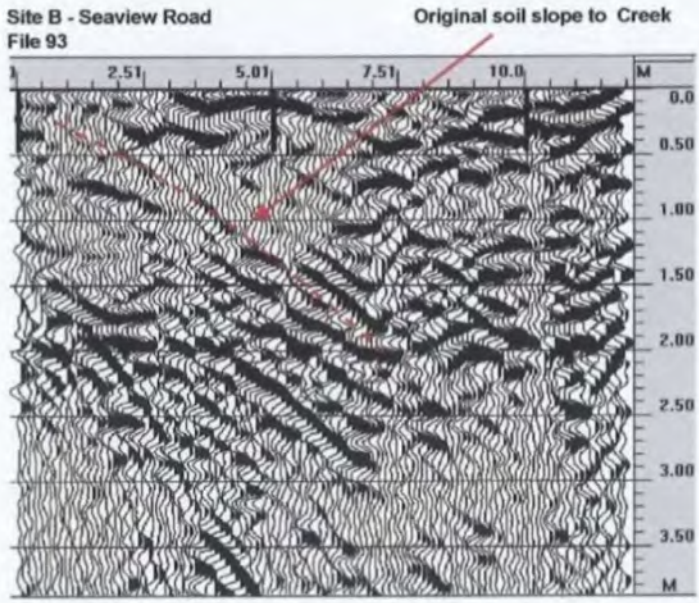


Figure 2b

TRC Site C – Pylon 3

Location:

This site covers the area immediately around Transpower EHV Transmission line Pylon 3. It also includes approximately 250 metres of Centennial Drive as well as the area between Centennial Drive and the clifftop facing the sea from north of the carpark to the small bush-covered outcrop at the southern end. This total area is the largest of the areas surveyed.

GPR Survey:

A large number of GPR scan lines were run in a variety of directions in all of the areas where it was practical to carry out a scan. The survey effectively covers the whole area. Refer Fig. 3a. GPR radargram file references are Files 60 and 107 through to 153.

Six GPS positions were captured to record the extent of this survey. These are WPs 5, 6, 7, 8, 9, and 10.

Data Results:

In the area immediately surrounding Pylon 3, the area consisted of raised undulating terrain which dictated where survey lines could be carried out. Typical GPR results are shown on Fig. 3b and show generally horizontal or undulating undisturbed soil strata lines. No significant anomalies were detected.

GPR data collected along and across Centennial Drive showed the installed underground pipelines running towards the port.

The majority of the GPR data collected in the area between Centennial Drive and the clifftop showed generally horizontal to undulating undisturbed soil strata with no significant anomalies evident. A number of underground stormwater drain pipes were detected running between Centennial Drive and the coastline. Refer Fig. 3c.

At the southern end of the area between Centennial Drive and the clifftop, an anomalous area was detected. Refer Fig. 3d. which shows the results seen on Radargram File 139 and File 60. This anomaly shows some evidence of disturbed subsurface strata with diffractions from likely buried objects.

Conclusions:

The majority of the data collected at this site revealed generally undulating soil strata with a large number of gas and drainage pipelines.

The most significant anomaly detected can be seen on Radargram Files 139 and 60. Further investigation would be necessary to determine the cause of this anomaly.

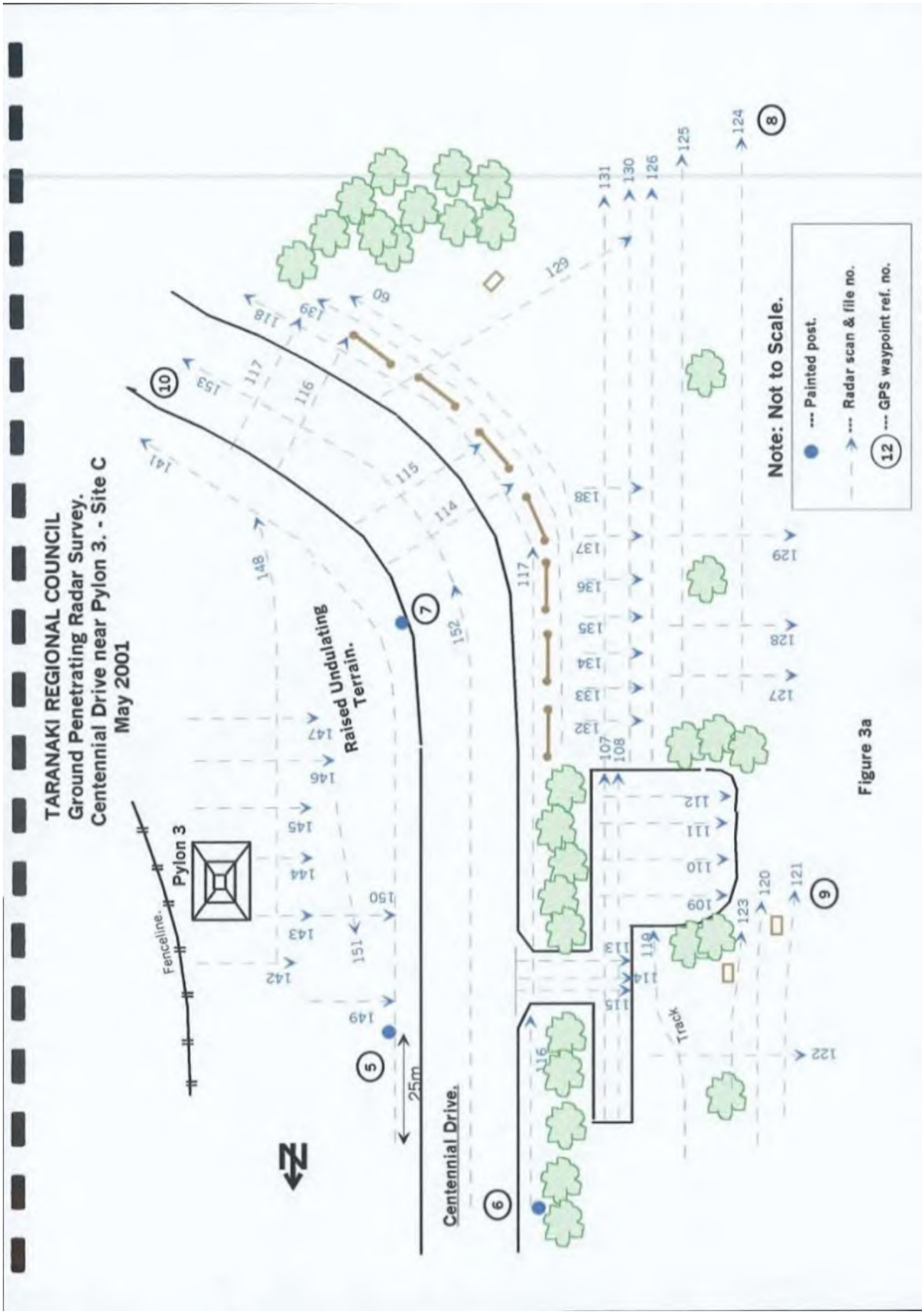

TARANAKI REGIONAL COUNCIL
Ground Penetrating Radar Survey.
Centennial Drive near Pylon 3. - Site C
May 2001
Pylon 3
Fenceline.
Raised Undulating Terrain.
Centennial Drive.
Track
25m
Note: Not to Scale.
--- Painted post.
--- Radar scan & file no.
12 --- GPS waypoint ref. no.

Figure 3a

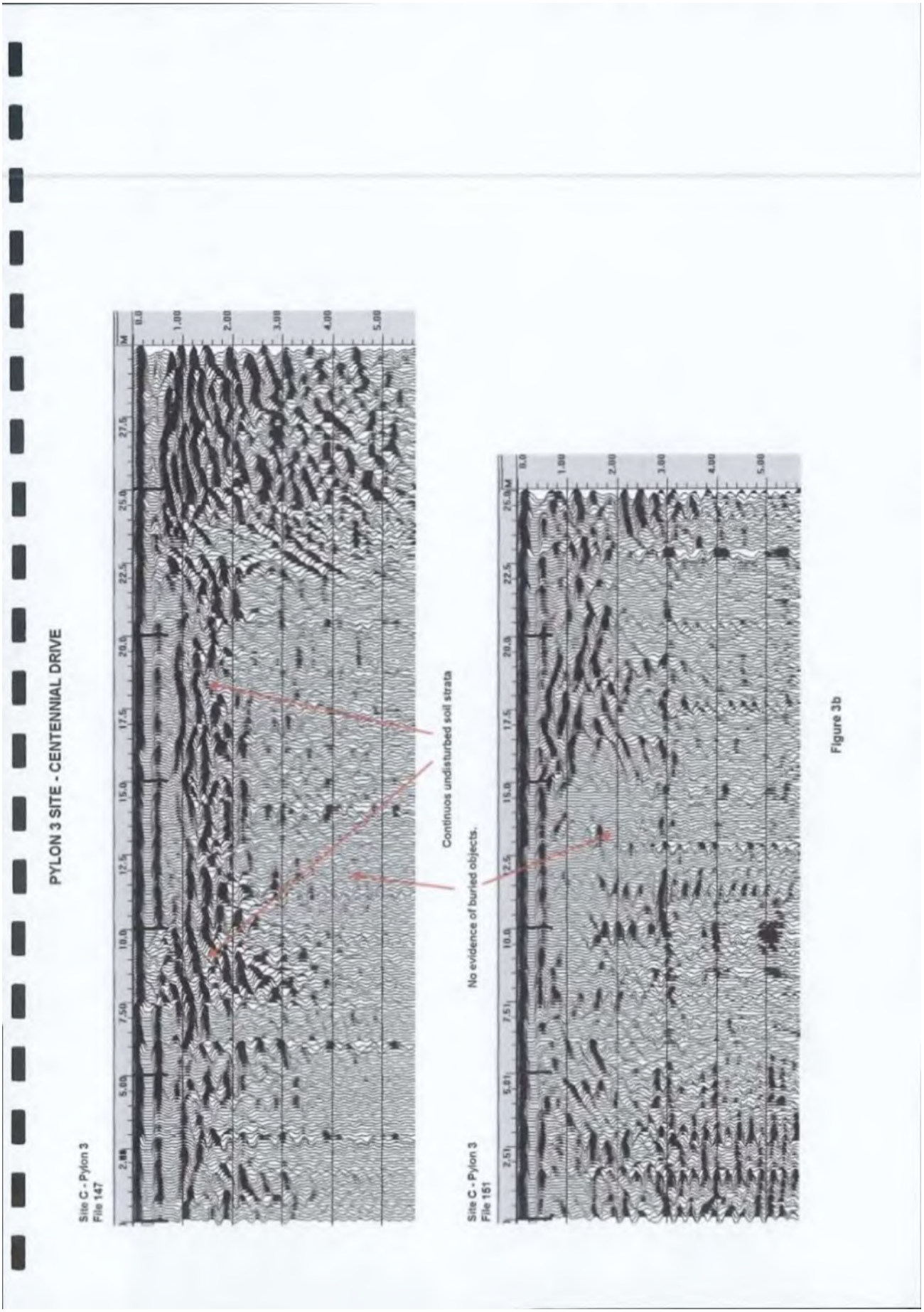

PYLON 3 SITE - CENTENNIAL DRIVE
Site C - Pylon 3
File 147
Continuous undisturbed soil strata
No evidence of buried objects.
Site C - Pylon 3
File 151

Figure 3b

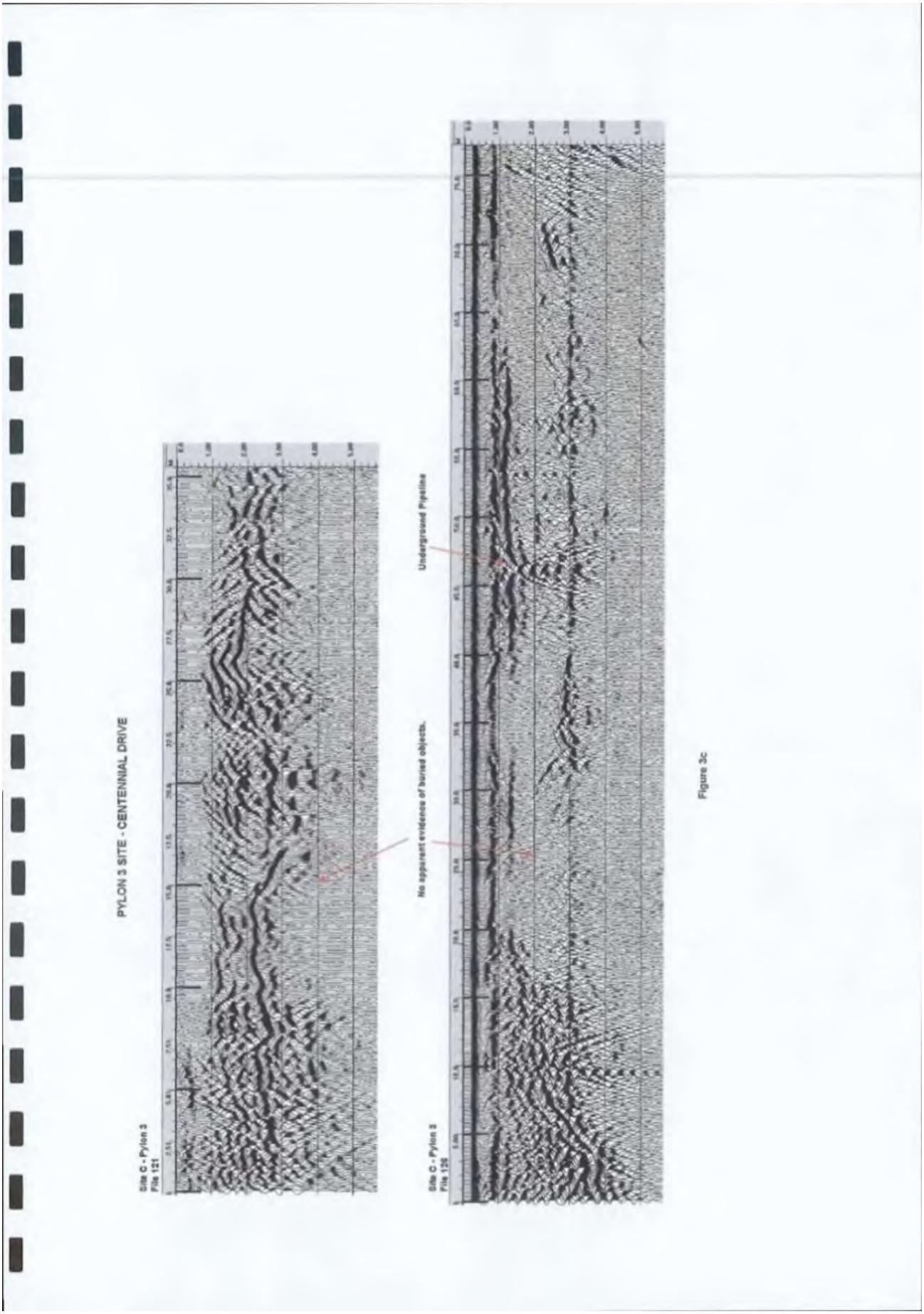

PYLON 3 SITE - CENTENNIAL DRIVE
Underground Pipeline
No apparent evidence of buried objects.
Site C - Pylon 3
Pits 121
Site C - Pylon 3
Pits 125

Figure 3c

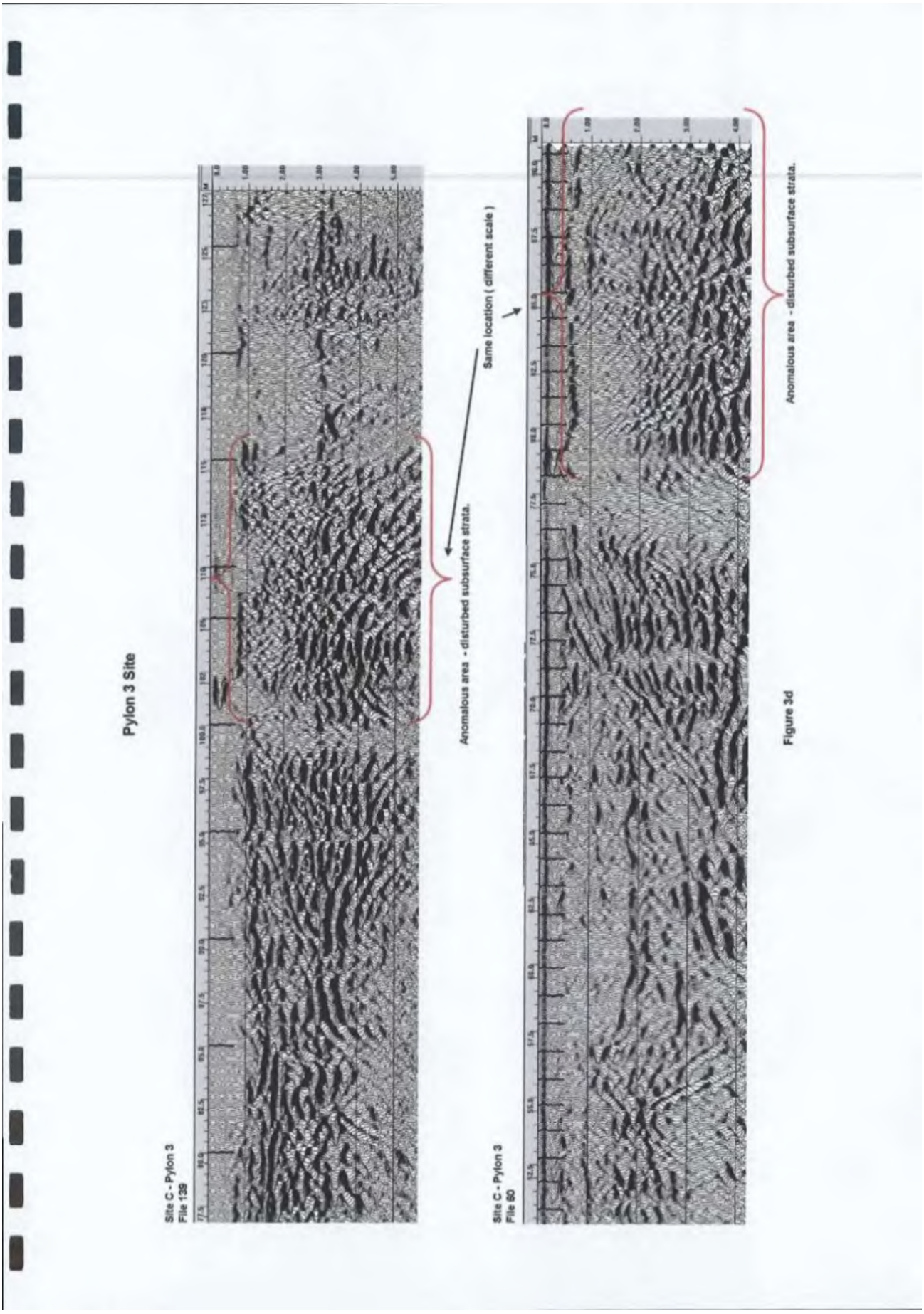

Pylon 3 Site
Site C - Pylon 3
File 139
Anomalous area - disturbed subsurface strata.
Same location (different scale)
Site C - Pylon 3
File 80
Anomalous area - disturbed subsurface strata.

Figure 3d

TRC Site D – 34 Rangitake Street.

Location:

This site consisted of the front and back garden lawn areas of house No 34 Rangitake Street.

GPR Survey:

GPR scan lines were run across the front lawn immediately behind the house, under the rear piled area of the house and the lower lawn area at the rear of the section. Refer Fig. 4a. GPR radargram file references are Files 57 through to 63. GPS positions were not considered necessary for residential sites.

Data Results:

GPR Radargrams Files, 57, 58, 59 and 63 showed normal soil strata with no obvious or significant anomalies. At the rear of the section on the lower lawn area, however, significant diffractions were detected on the southern end of the lawn. These are consistent with reflections from a few large buried objects. These can be seen on Radargram File 60 and 61. Refer Fig 4B.

Conclusions:

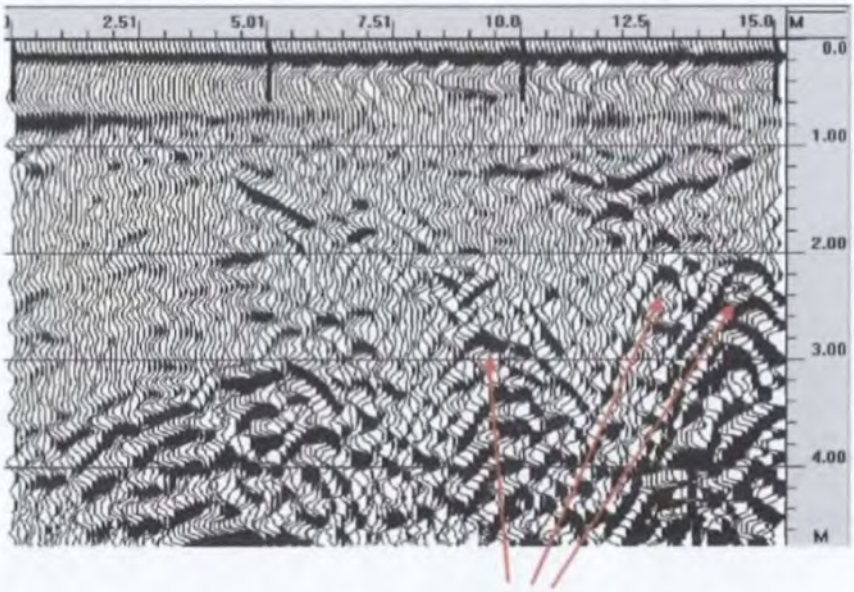
The data collected from this site did not reveal significant anomalies in the majority of the section. The data from one end of the rear lower lawn area, however, does indicate anomalies which are consistent with large buried objects such as drums. Further investigation would be necessary to determine the nature of the anomaly.

TARANAKI REGIONAL COUNCIL
Ground Penetrating Radar Survey.
34 Rangitake Street - Site D
May 2001

Figure 4a

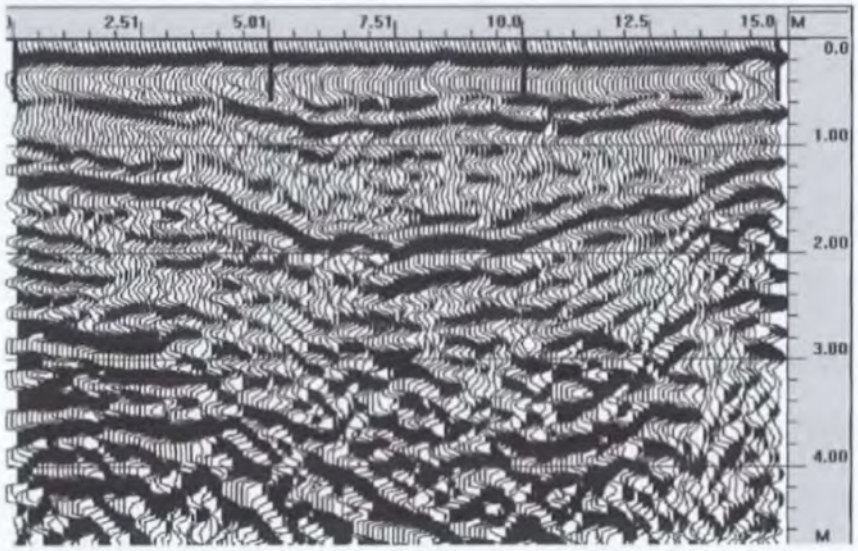
34 Rangitake Street

Site D - 34 Rangitake Street
File 60



Diffractions - possible large buried objects.

Site D - 34 Rangitake Street
File 61



Figur 4b

TRC Site E – Omata Reserve off Centennial Drive

Location:

This site is situated in the Omata Reserve area on the seaward side off Centennial Drive north of Herekawe Drive.

GPR Survey:

GPR scan lines were run in north to south and east to west directions to cover this site of approximately 20 metres x 20 metres. Refer Fig. 5a. GPR radargram file references are Files 69 through to 73.

GPS position WP27 was captured to record the location of this survey.

Data Results:

GPR data showed unbroken soil strata lines with no obvious anomalies or signs of previous excavation. Refer Fig 5b which shows typical radargrams collected at this site.

Conclusions:

All of the data collected from this site did not show evidence of a drum burial site

TARANAKI REGIONAL COUNCIL
Ground Penetrating Radar Survey.
Omata Reserve - Site E - Off Centennial Drive.
May 2001

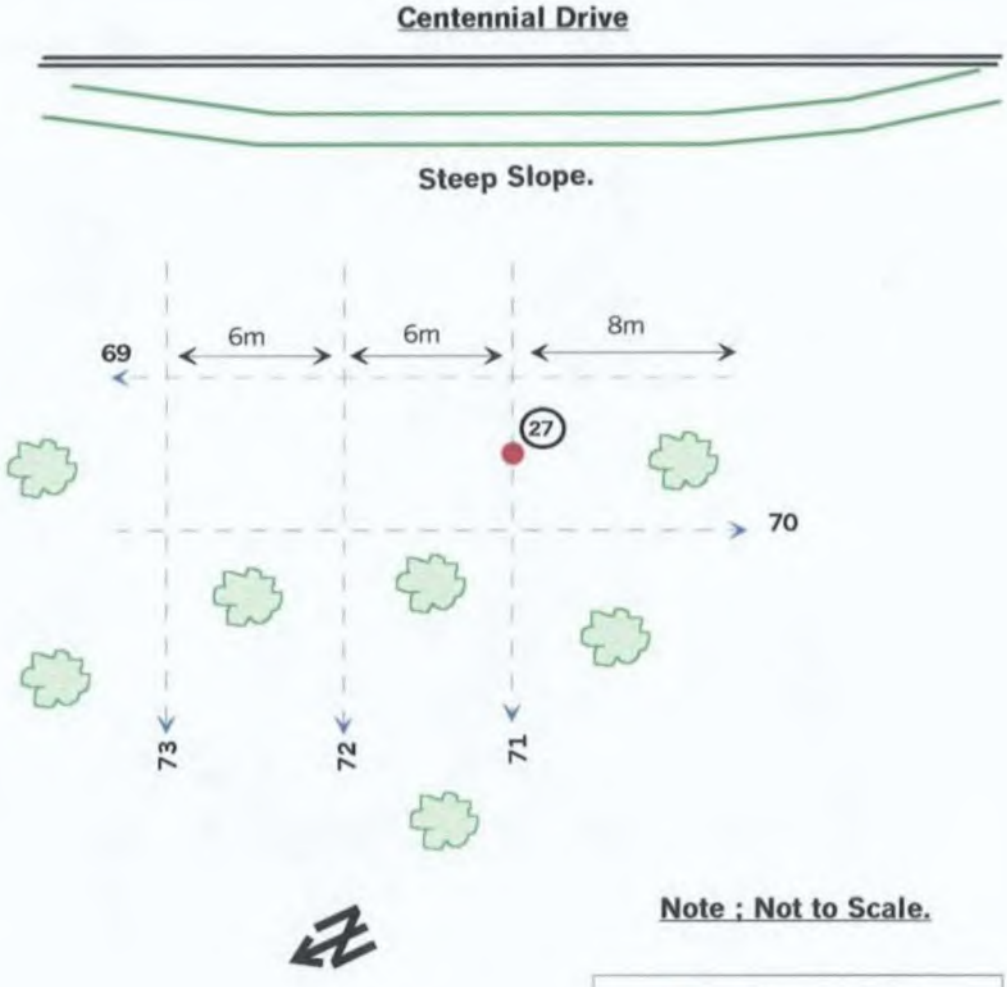
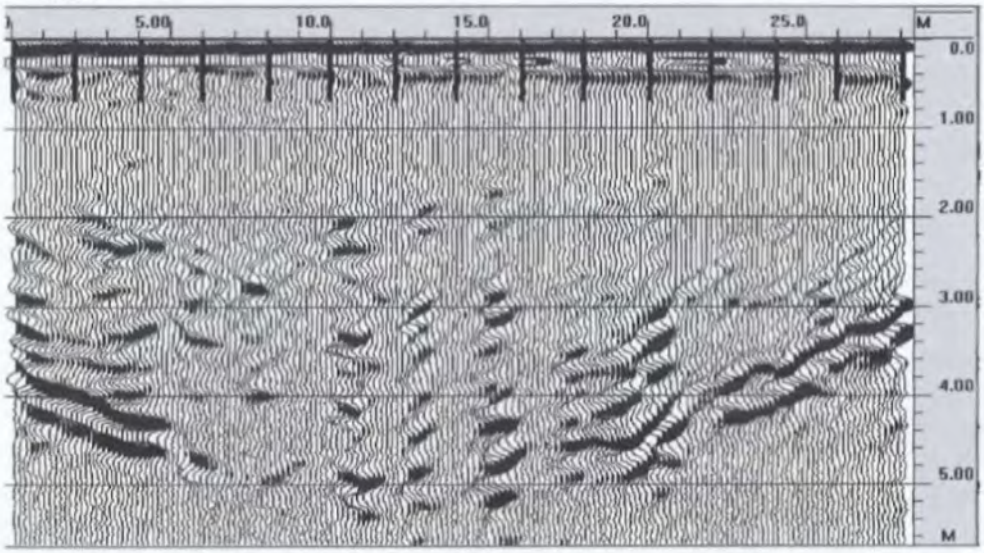


Figure 5a

Omata Reserve - Centennial Drive

Site E - Omata Reserve
File 72



No anomalous areas apparent in Radargrams.

Site E - Omata Reserve
File 73

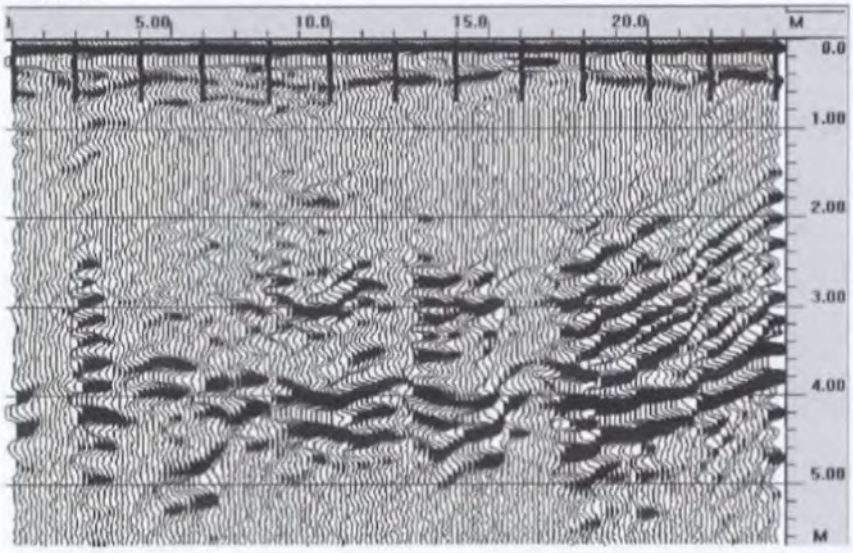


Figure 5b

TRC Site – House No 44 Rangitake Street

Location:

This site covers the front and back garden areas of House No 44 Rangitake Street. The area at the far rear of House No 44 was fenced off and severely overgrown with vegetation and was therefore not able to be surveyed at this stage. Also included is the vacant lot immediately north of House No 44.

GPR Survey:

GPR scan lines were run in a north to south direction in the front and rear gardens of House No 44. GPR scan lines were run in an east to west direction to cover the vacant lot adjacent to House 44. Refer Fig. 6a. GPR radargram file references are Files 97 through to 105.

GPS position WP11 was captured to record the extent of the survey on the vacant section.

Data Results:

GPR data showed strong diffractions in the rear garden of House No 44. These strong diffractions are likely to have been caused by a few large buried objects. Refer Fig 6b.

No significant anomalous areas were detected in the front garden of House No 44 or on the adjacent vacant lot. Refer Fig 6c which shows the results of a typical scan taken across the adjacent vacant section.

Conclusions:

Further investigation of the rear garden of House No 44 would be necessary to determine the nature of the anomaly.

TARANAKI REGIONAL COUNCIL
Ground Penetrating Radar Survey.
44 Rangitake Street. - Site Da
May 2001

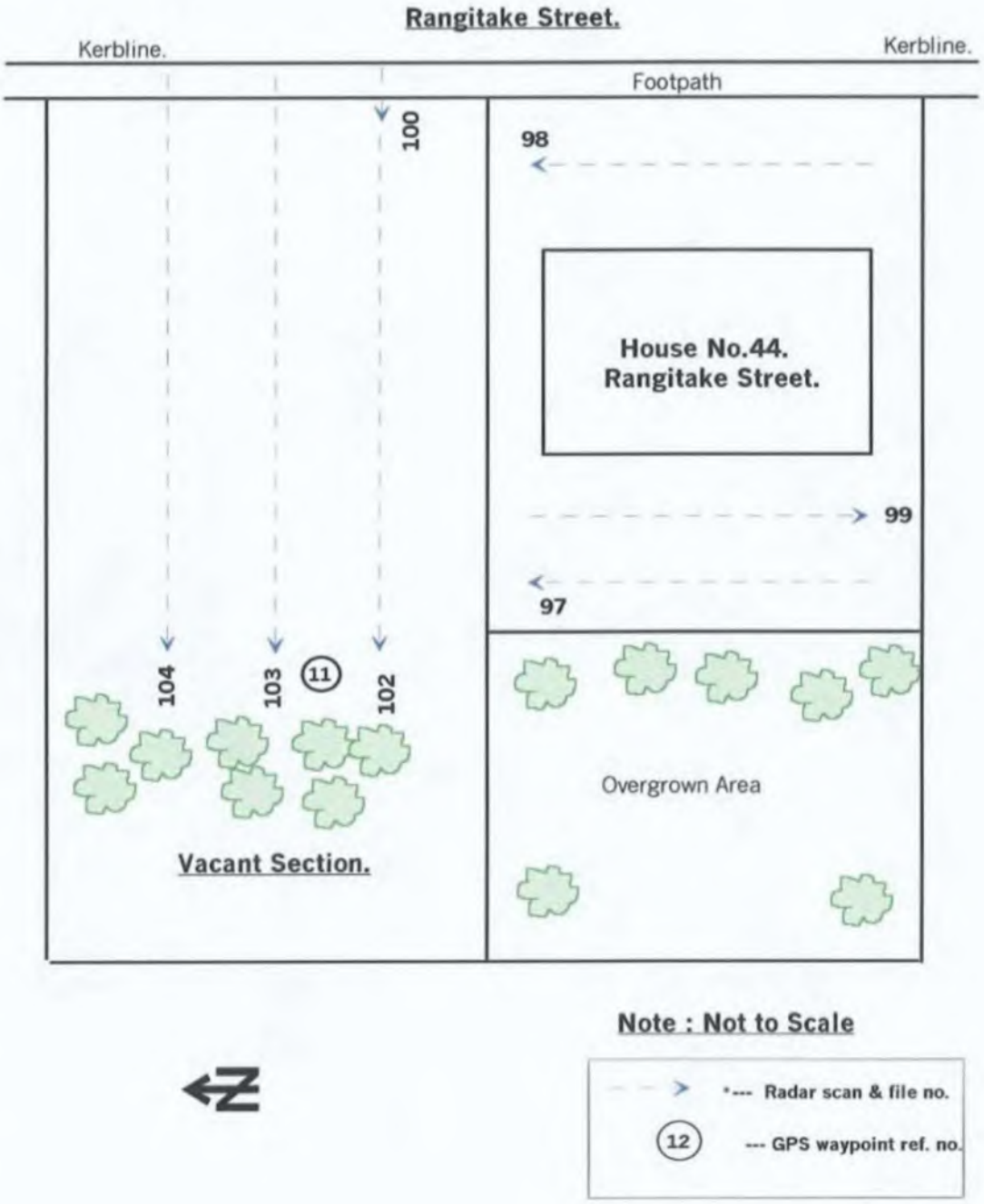


Figure 6a

44 Rangitake Street.

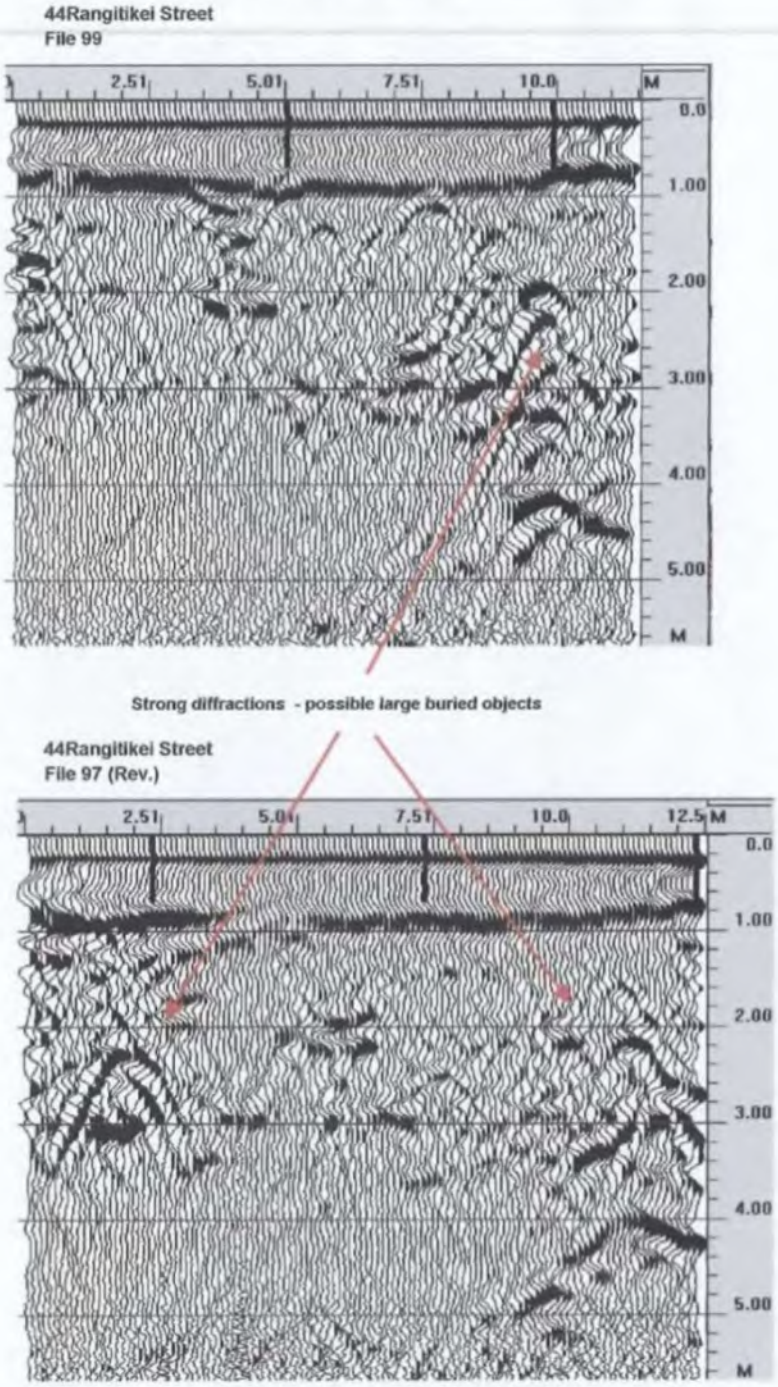


Figure 6b

TRC Site – Rangitake Street

Location:

This site covers Rangitake Street from the end of the cul-de-sac as far as Herekawe Drive.

GPR Survey:

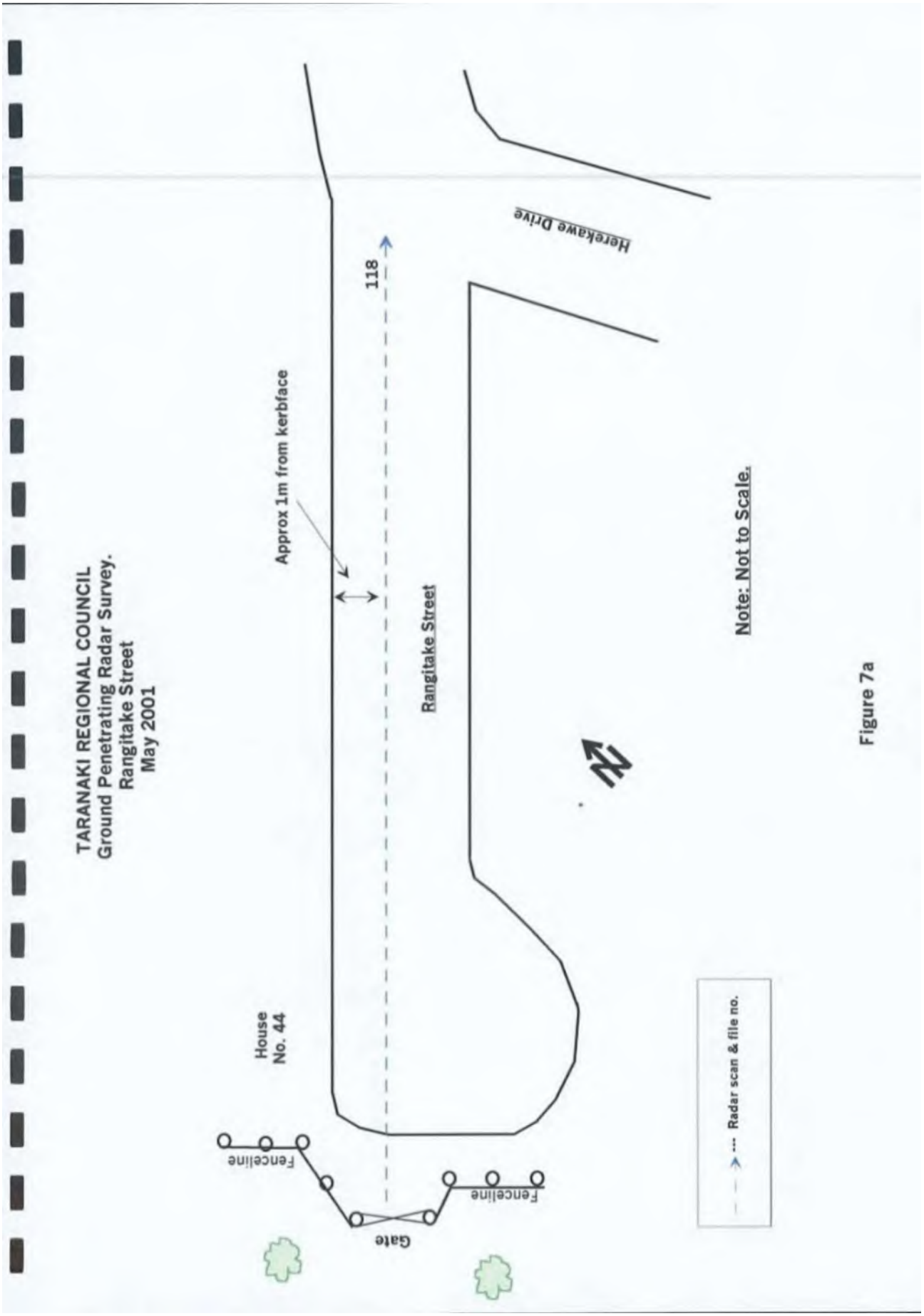
GPR scan lines were run from the farm gate at the southern gate at the southern end of Rangitake Street along the street as far as Herekawe Drive approximately one metre into the roadway measured from the kerbface. Refer Fig. 7a. GPR radargram file reference is Files 118.

Data Results:

GPR data along this street showed various underground services' location. No significant anomalies were detected.

Conclusions:

All of the data collected from this site did not show evidence of a drum burial site.


TARANAKI REGIONAL COUNCIL
Ground Penetrating Radar Survey.
Rangitake Street
May 2001
Approx 1m from kerbface
118
Rangitake Street
Herekawe Drive
House
No. 44
Fenceline
Gate
Fenceline
--- Radar scan & file no.
Note: Not to Scale.
Figure 7a

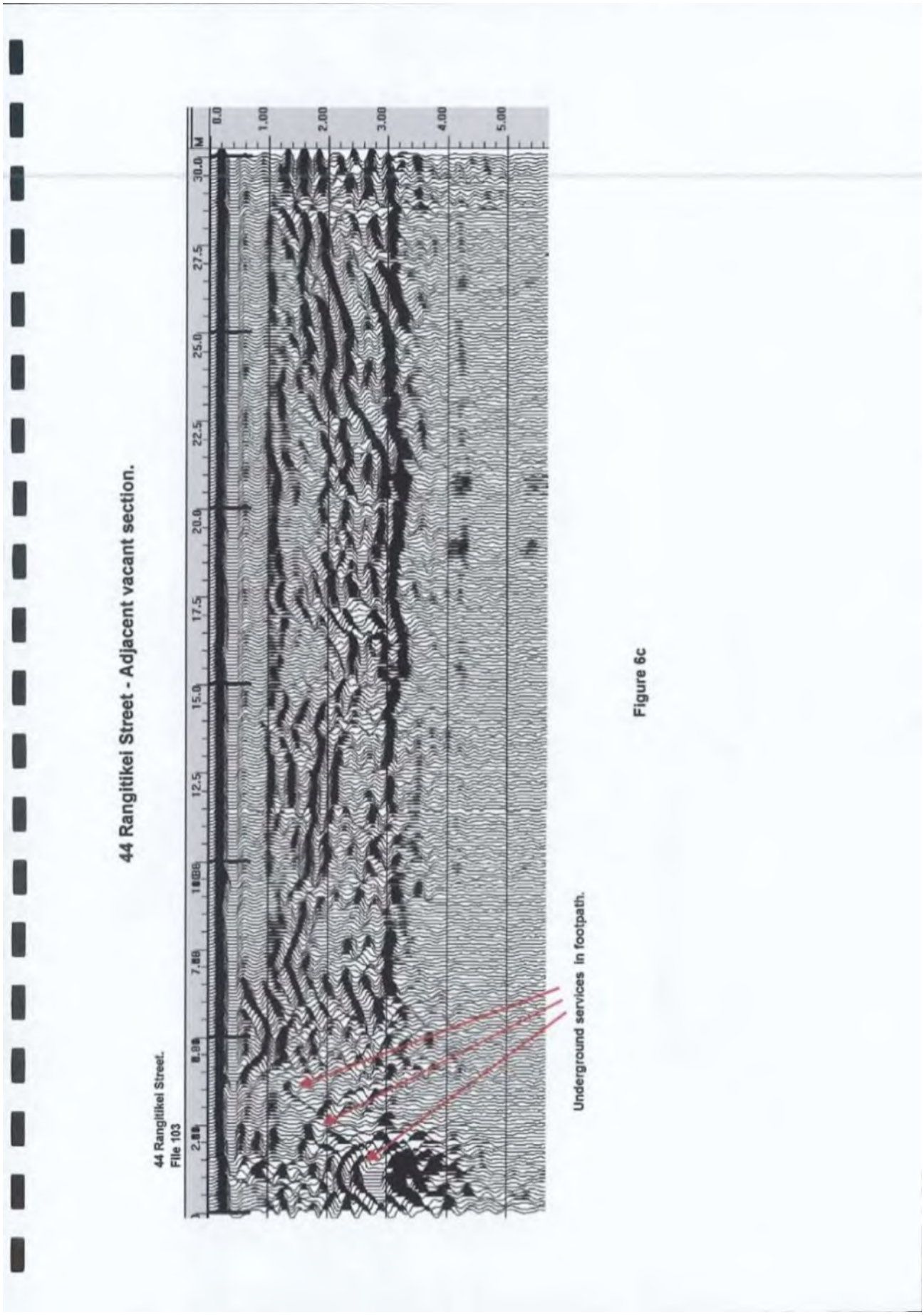

44 Rangitikei Street - Adjacent vacant section.
44 Rangitikei Street.
File 103
Underground services in footpath.

Figure 6c

TRC Site P – 26A Rangitake Street.

Location:

This survey covered the front, rear, both sides and a portion of the driveway of 26A Rangitake Street.

GPR Survey:

GPR scan lines were run in north to south and east to west directions to completely cover the area around House No 26A. Refer Fig 8a. GPR radargram file references are Files 48 through to 56.

The lower back garden has been terraced and was extremely wet at the time of the survey due to ground water movement.

GPS position WP12 was captured to record the extent of this survey.

Data Results:

GPR scans across the rear garden area revealed diffractions due most likely to several large buried objects. Refer Fig. 8b. Radargram File 51. In addition, GPR scans across the front of the house (refer radargram File 55 - Fig. 8b) appears to show evidence of disturbed subsurface strata with multiple diffractions due most likely to buried objects.

The remainder of the GPR data collected on this site did not show any other significant anomalies.

Conclusions:

Further investigation of the area immediately in front of the house and behind would be necessary to determine the nature of the anomalies.

TARANAKI REGIONAL COUNCIL
Ground Penetrating Radar Survey.
26A Rangitake Street - Site P
May 2001

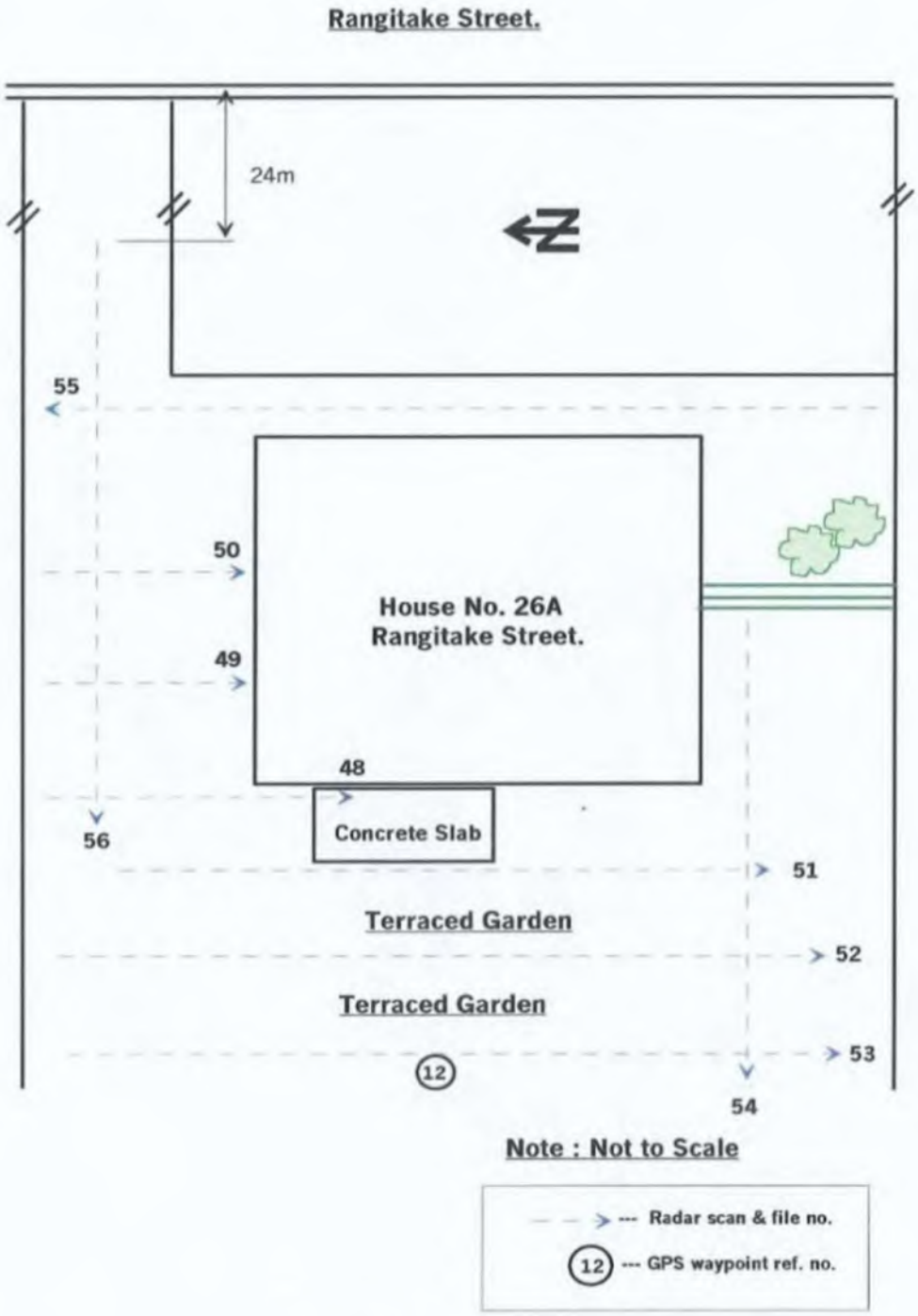


Figure 8a

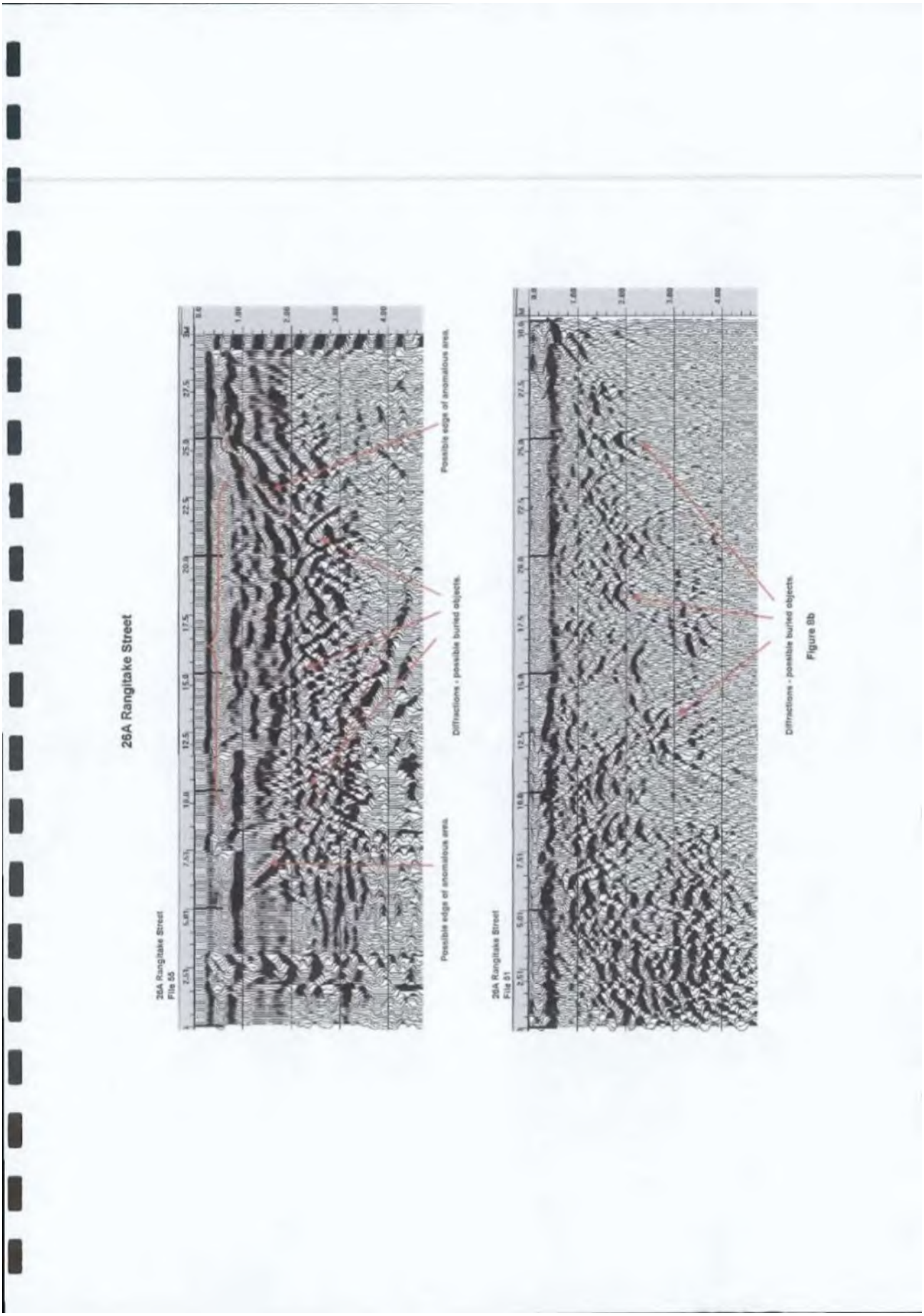

26A Rangitake Street
26A Rangitake Street File 55
Possible edge of anomalous area.
Diffractions - possible buried objects.
Possible edge of anomalous area.
26A Rangitake Street File 01
Diffractions - possible buried objects.

Figure 8b

TRC Site M – Gully off Beach Road

Location:

This site is situated on farmland at the bottom of a gully adjacent to the Clay Pigeon Shooting Club premises off Centennial Drive. It consists of a narrow walking track running alongside a swamp area and is backed by a steep hillside on the southern side.

GPR Survey:

GPR scan lines were run along the walking track in a west to east direction as well as down and across the adjacent hillside. Refer Fig. 9a. GPR radargram file references are Files 43 through to 46.

GPS position WP26 was captured to record the location of this survey.

Data Results:

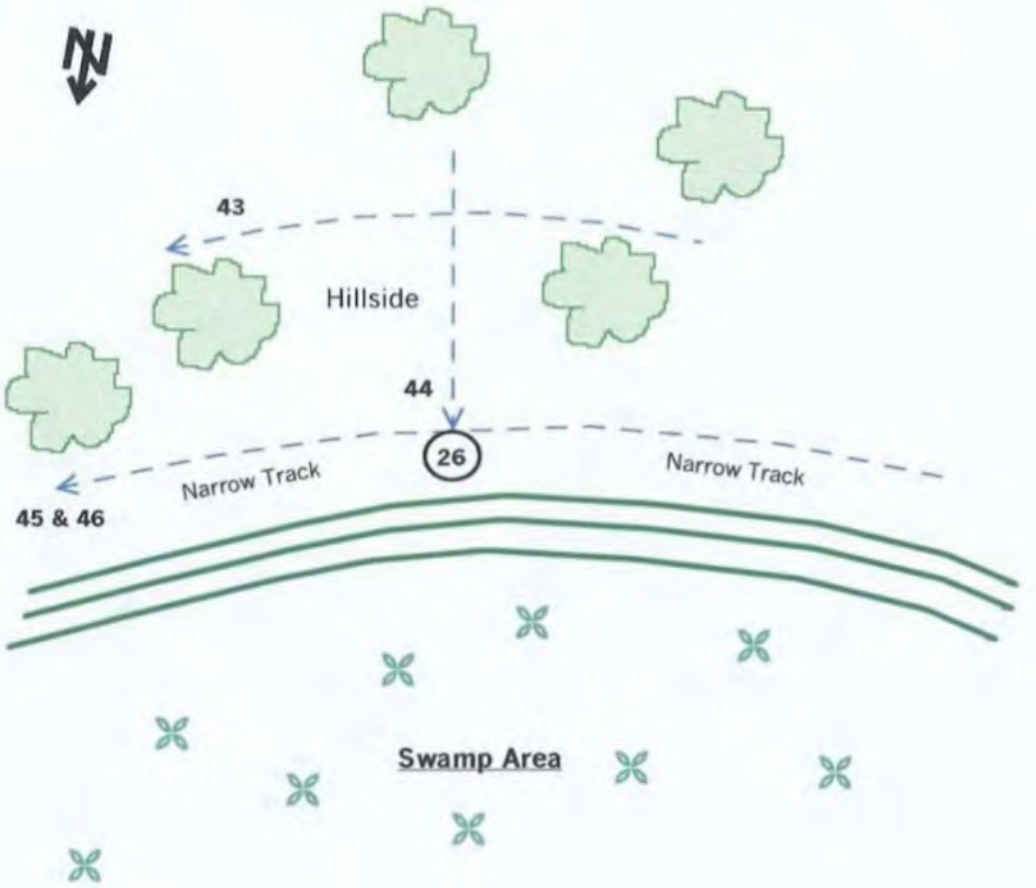
GPR data revealed normal undulating soil strata with no significant anomalies over the majority of this site.

The GPR scan lines along the track, (Radargram File 45 and 46) however, showed significant diffractions from large, round objects. The type of diffraction seen here is normally associated with pipelines. However, no physical evidence of pipelines could be seen on this site.

Conclusions:

Further investigation would be necessary to determine if the diffractions detected are due to buried pipelines or large buried objects.

TARANAKI REGIONAL COUNCIL
Ground Penetrating Radar Survey.
Site M- Gully off Centennial Drive
May 2001



--- Radar scan & file no.

(12) --- GPS waypoint ref. no.

Note: Not to Scale.

Figure 9a

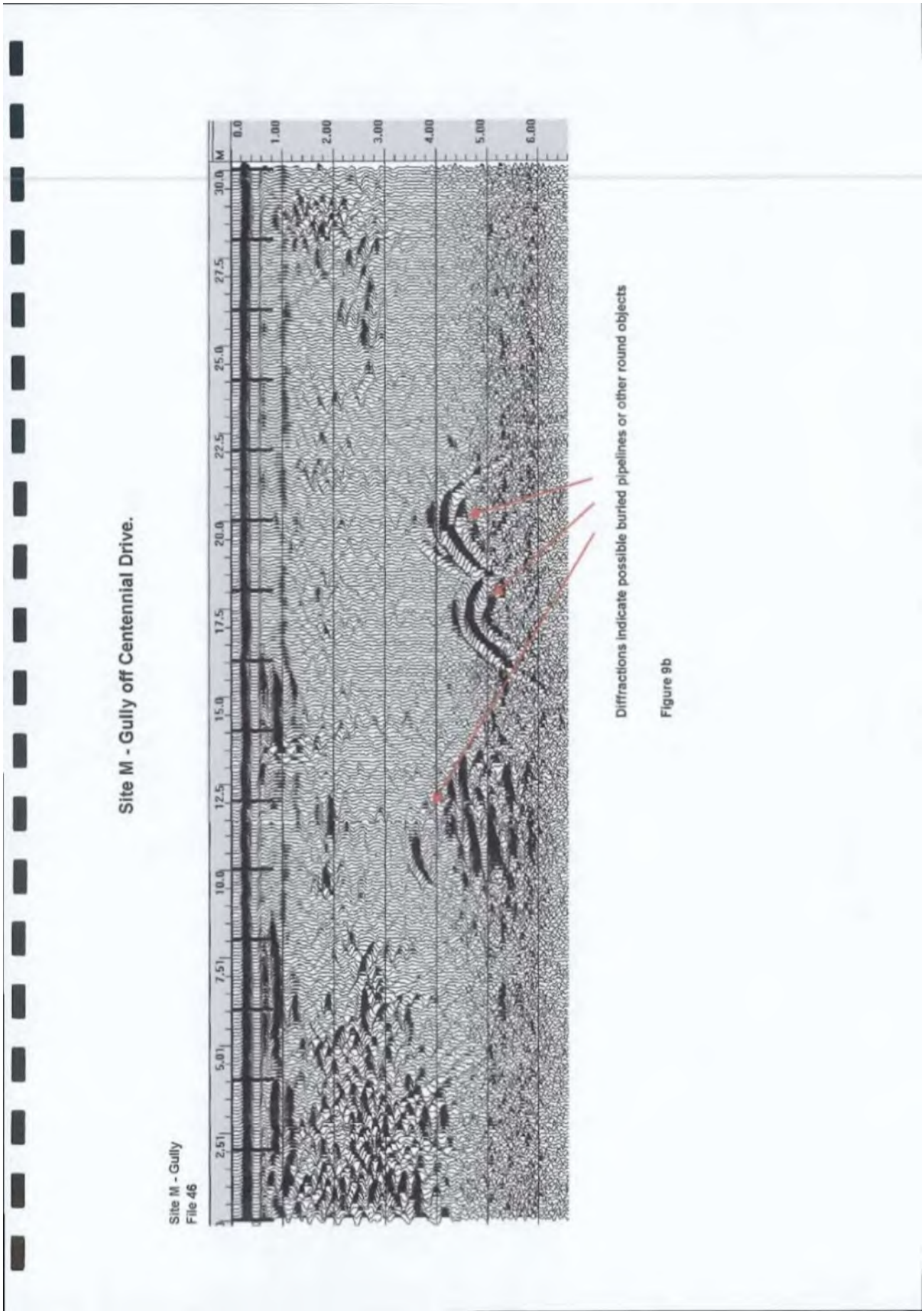

Site M - Gully off Centennial Drive.
Site M - Gully
File 46
M
0.0
1.00
2.00
3.00
4.00
5.00
6.00
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0
27.5
30.0
Diffractions indicate possible buried pipelines or other round objects

Figure 9b

TRC Site X – Roto Street

Location:

This site is situated off Roto Street up a gravel track and is surrounded by trees and vegetation. It appears to have been a small gully that has been used as a landfill site. Evidence of rubbish and debris could be seen on the surface at this site.

GPR Survey:

GPR scan lines were run in north tosouth and east to west directions to cover this site and a portion of the gravel track leading to it. Refer Fig. 10a. GPR radargram file references are Files 74 through to 77.

Two GPS positions, WP13 and WP14 were captured to record the extent and location of this survey.

Data Results:

GPR data showed scattered diffractions indicating that the majority of the area scanned consists of fill and debris material. This result is typical of a general landfill area. The original ground level can be seen at the end of the GPR scan lines. Refer Fig 10b and radargram File 75.

Conclusions:

All of the data collected from this site did not show evidence of a drum burial site.

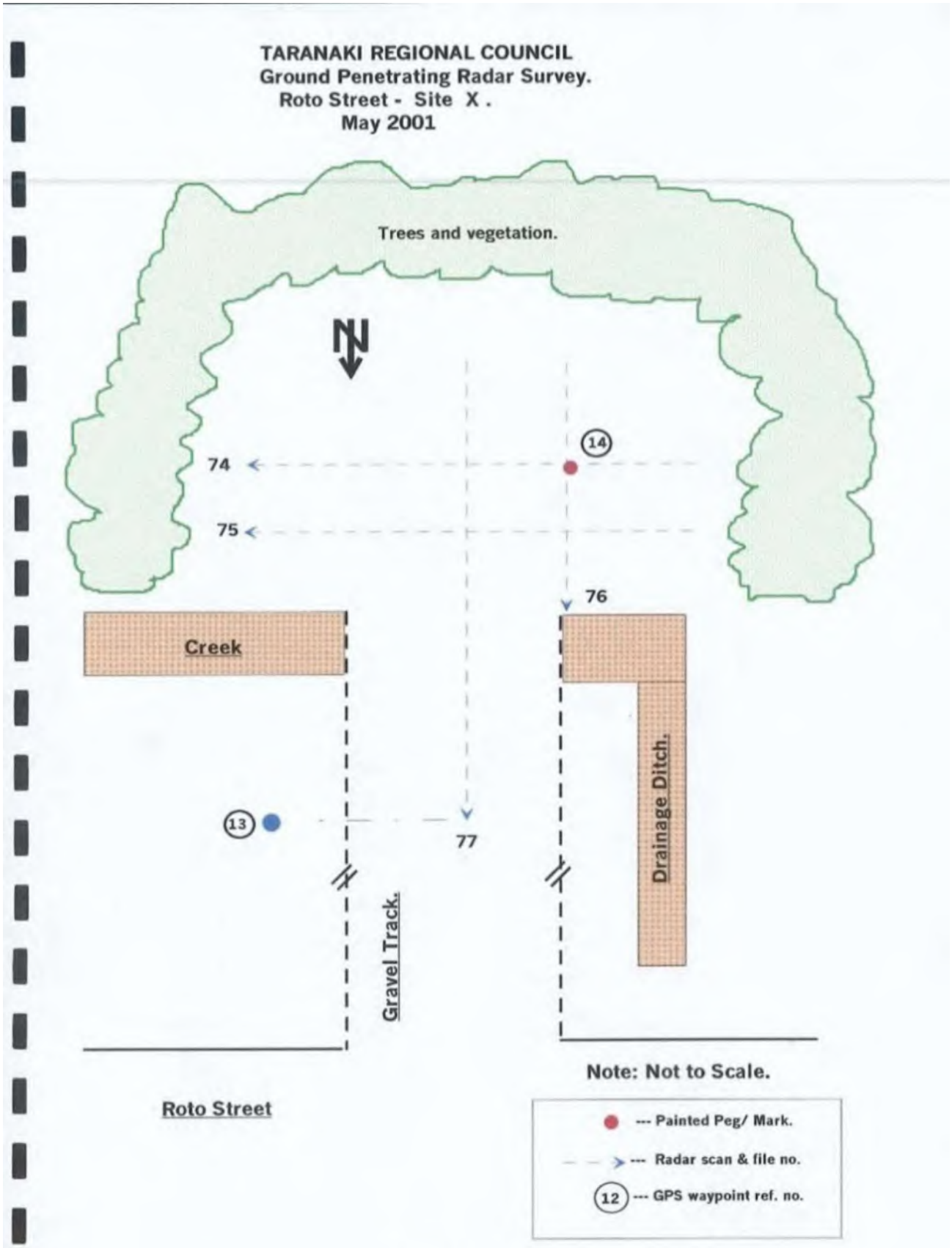

TARANAKI REGIONAL COUNCIL
Ground Penetrating Radar Survey.
Roto Street - Site X .
May 2001
Trees and vegetation.
N
74
75
14
76
Creek
Drainage Ditch.
13
77
Gravel Track.
Roto Street
Note: Not to Scale.
--- Painted Peg/ Mark.
--- Radar scan & file no.
12 --- GPS waypoint ref. no.

Figure 10a

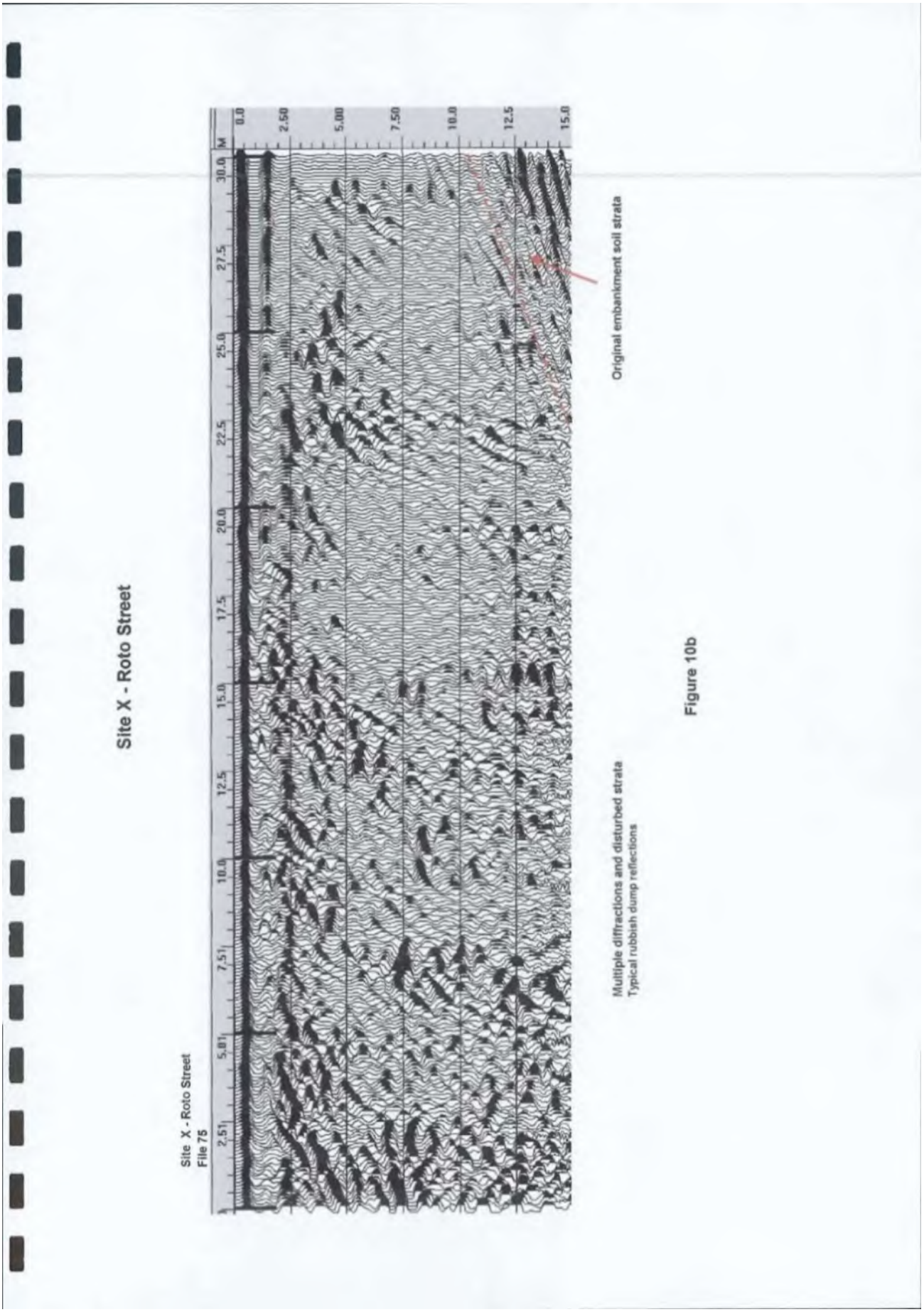

Site X - Roto Street
Site X - Roto Street
File 75
Original embankment soil strata
Multiple diffractions and disturbed strata
Typical rubbish dump reflections

Figure 10b

TRC Site R – Beach Road

Location:

This site is in a farm paddock on the north side of Beach Road near the junction with Centennial Drive.

GPR Survey:

GPR scan lines were run in east to west and north to south directions. Scans were spaced at approximately five metres to ensure an adequate search of this site. Refer Fig. 11a. GPR radargram file references are Files 35 through to 40.

GPS position WP18 was captured to record the location of this survey.

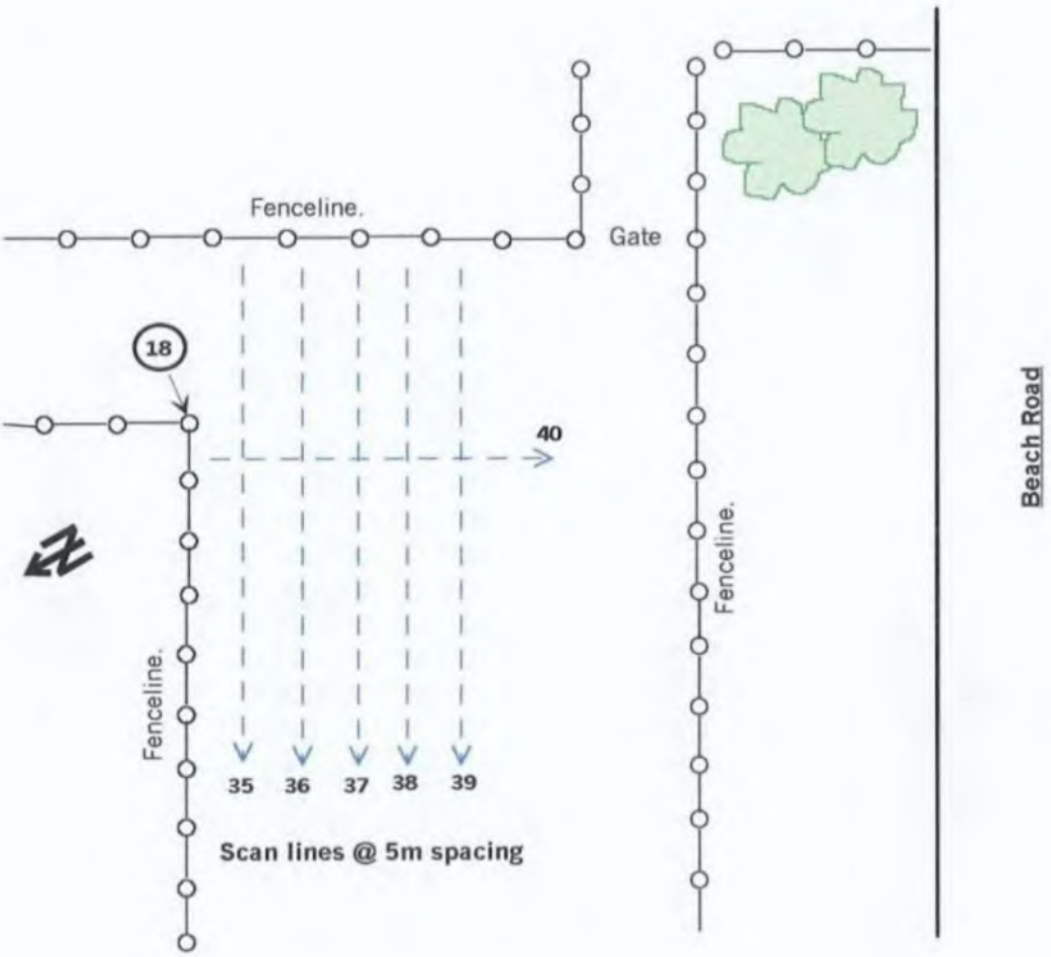
Data Results:

GPR data showed normal undulating soil strata in the area surveyed. No significant anomalies were detected.

Conclusions:

All of the data collected from this site did not show evidence of a drum burial site.

TARANAKI REGIONAL COUNCIL
Ground Penetrating Radar Survey.
Site R off Beach Road.
May 2001



--- Radar scan & file no.

12 --- GPS waypoint ref. no.

Note: Not to Scale.

Figure 11a

TRC Site – Omata Reserve beside Herekawe Stream

Location:

This site is situated on a hillside leading down from the Omata Tank premises towards the Herekawe Stream on the east side of Centennial Drive. The whole site was covered with dense vegetation which had to be cleared to allow GPR survey lines.

GPR Survey:

GPR scan lines were run in south to north and east to west directions. Scan lines were only possible where vegetation had been sufficiently cleared. Refer Fig. 12a. GPR radargram file references are Files 154 through to 157.

A GPS position, WP25, was captured at the start point of this survey to record the location.

Data Results:

GPR data showed normal undulating soil strata in the area surveyed. No significant anomalies were detected.

Conclusions:

All of the data collected from this site did not show evidence of a drum burial site.

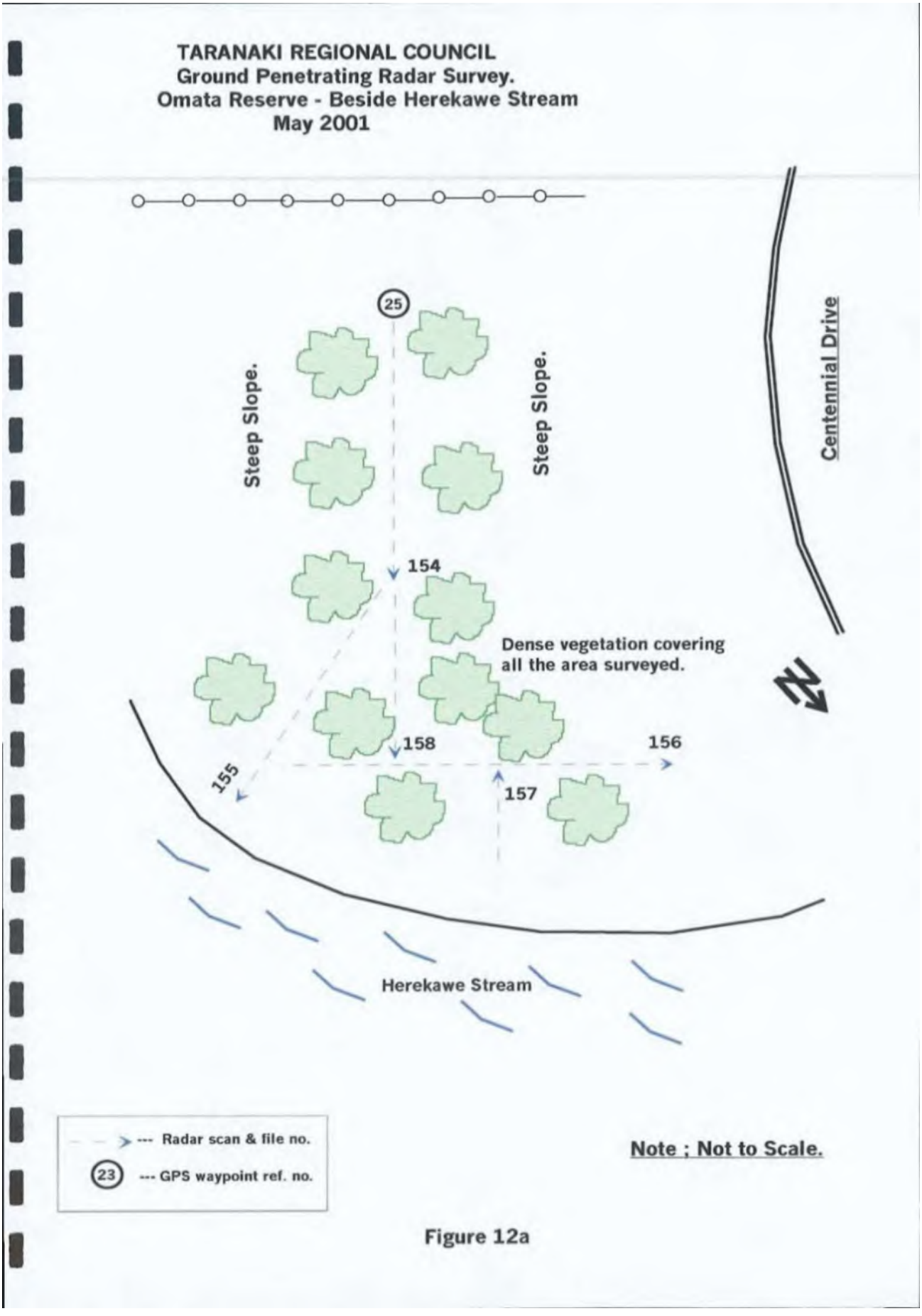

TARANAKI REGIONAL COUNCIL
Ground Penetrating Radar Survey.
Omata Reserve - Beside Herekawe Stream
May 2001
25
Steep Slope.
Steep Slope.
Centennial Drive
154
Dense vegetation covering
all the area surveyed.
158
156
155
157
Herekawe Stream
--- Radar scan & file no.
23 --- GPS waypoint ref. no.
Note ; Not to Scale.

Figure 12a

TRC Site Z – Ngahoro off Centennial Drive

Location:

This site is situated on the seaward side of Centennial Drive approximately 100 metres from the Beach Road corner. It consists of a road level paddock and a steep slope down to a lower level paddock.

GPR Survey:

GPR scan lines were run north to south and east to west directions to cover the upper and lower surveyed areas. Lines were spaced at approximately five metres. Refer Fig. 13a. GPR radargram file references are Files 19 through to 26 and 31 through to 34.

GPS position WP20 was captured to record the location of this survey.

Data Results:

GPR data collected at the upper level showed normal undulating soil strata with no significant anomalies detected. Refer Fig. 13b and radargram File 28.

GPR data taken from a point part-way down the slope and across the lower level did show an anomalous area consistent with a previous excavation. Refer Fig.13b and radargram File 32.

Conclusions:

The only significant anomaly detected at this site showed what appears to be evidence of a previous excavation. However, the data shows no evidence of buried drums.

TARANAKI REGIONAL COUNCIL
Ground Penetrating Radar Survey.
Ngahoro - Site Z - Off Centennial Drive.
May 2001

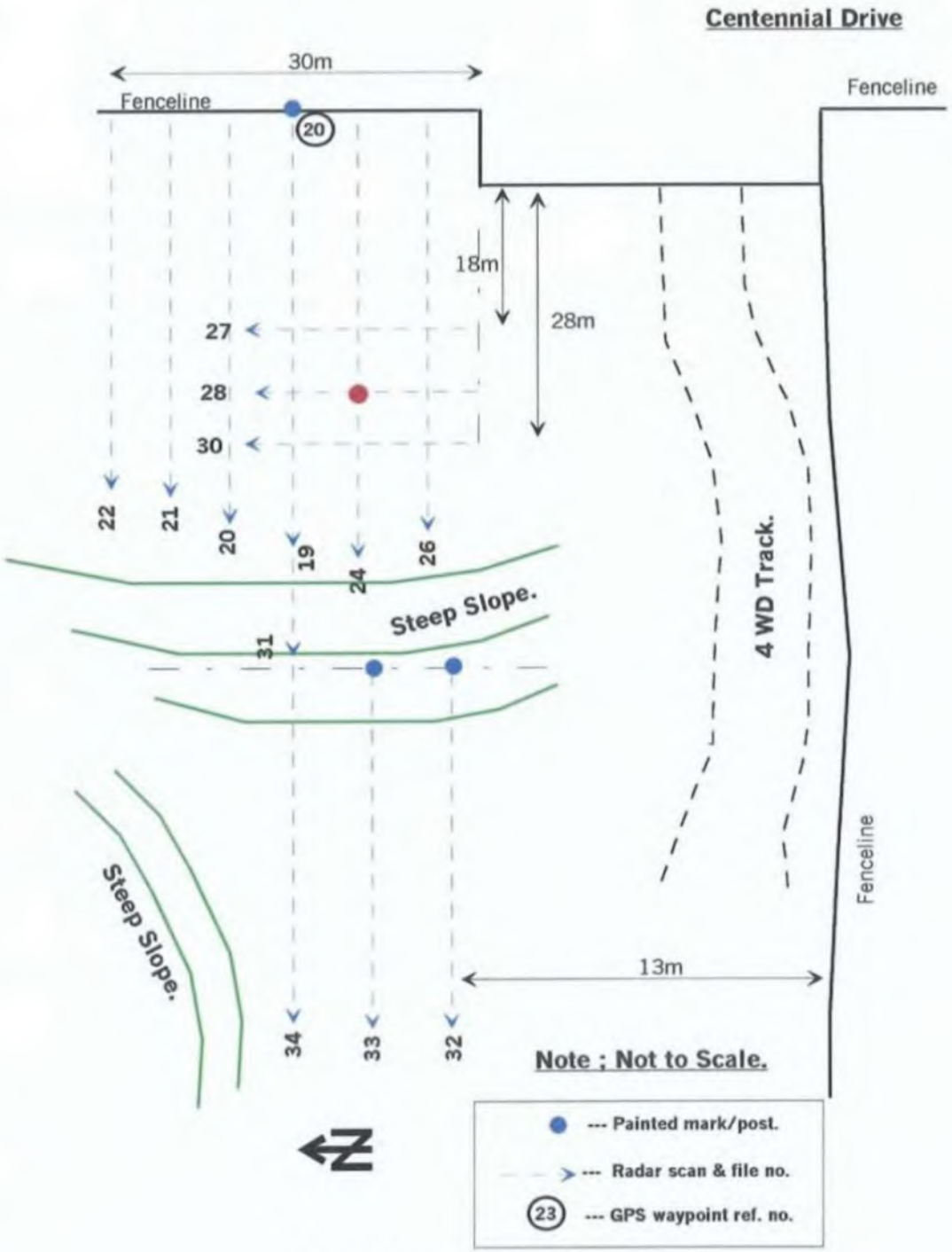


Figure 13a

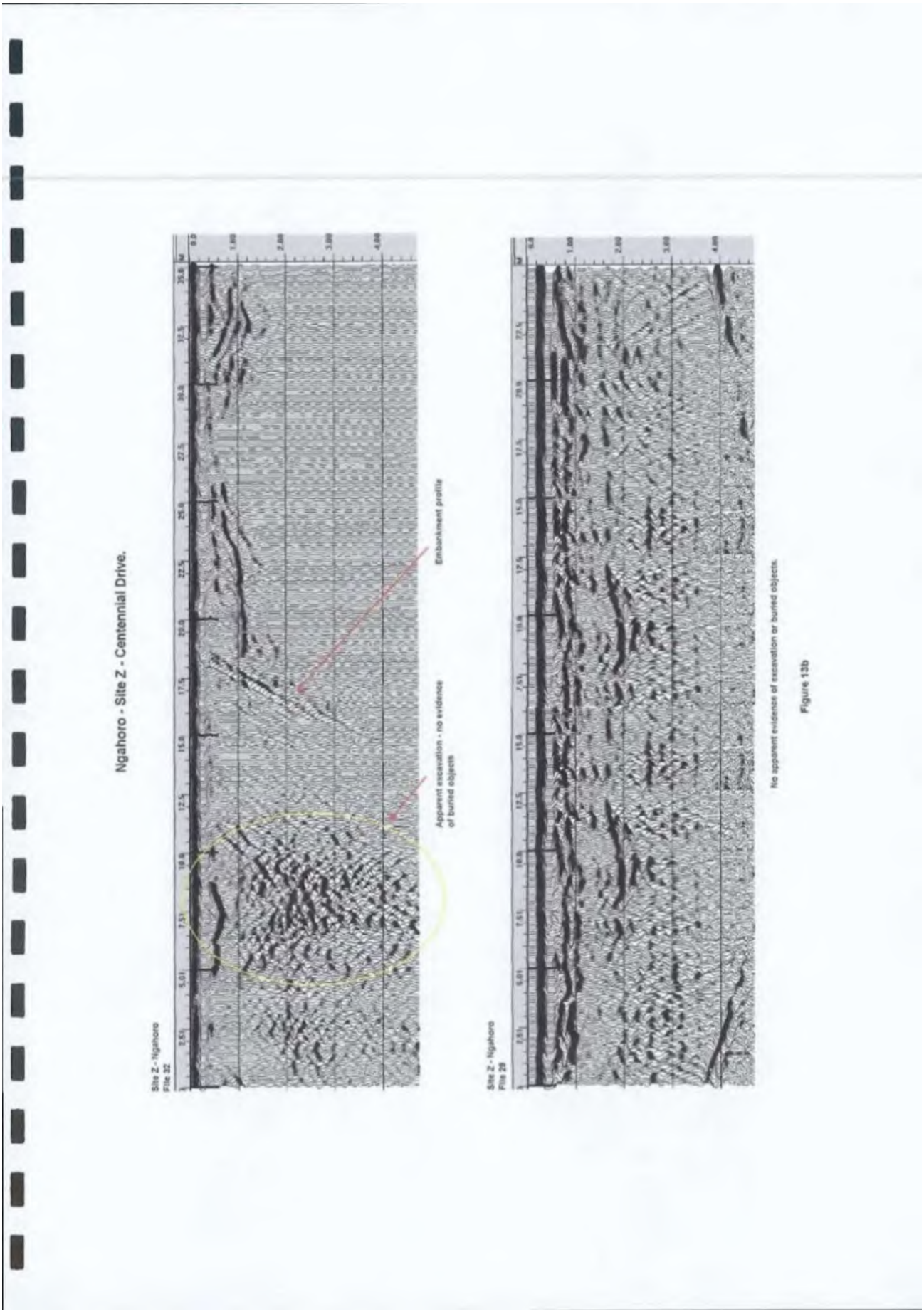

Ngahoro - Site Z - Centennial Drive.
Embankment profile
Apparent excavation - no evidence of buried objects
Site Z - Ngahoro File 32
Site Z - Ngahoro File 29
No apparent evidence of excavation or buried objects.

Figure 13b

TRC Site Za – 60 Marama Crescent

Location:

This site is situated in the rear garden lawn area of House No 60, Marama Crescent.

GPR Survey:

GPR scan lines were run in a north to south direction across the lawn as well as in an east to west direction down the length of the lawn. Refer Fig. 14a. GPR radargram file references are Files 64 through to 68.

Data Results:

GPR data collected from this site showed normal undulating soil strata with no evidence of excavation or significant anomalies. Refer Fig 14b.

Conclusions:

All of the data collected from this site did not show evidence of a drum burial site.

TARANAKI REGIONAL COUNCIL
Ground Penetrating Radar Survey.
60 Marama Crescent - Site Za
May 2001

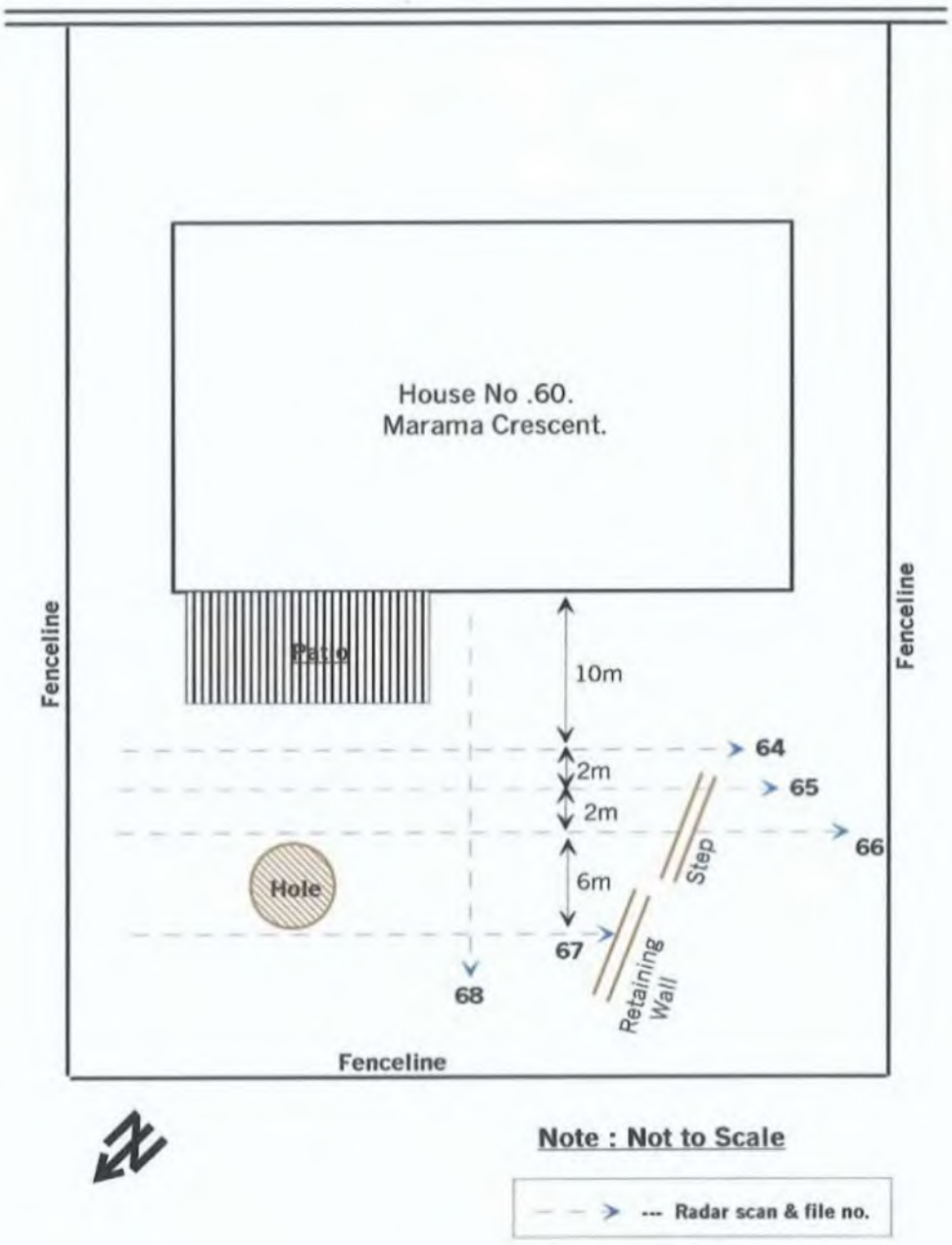


Figure 14a

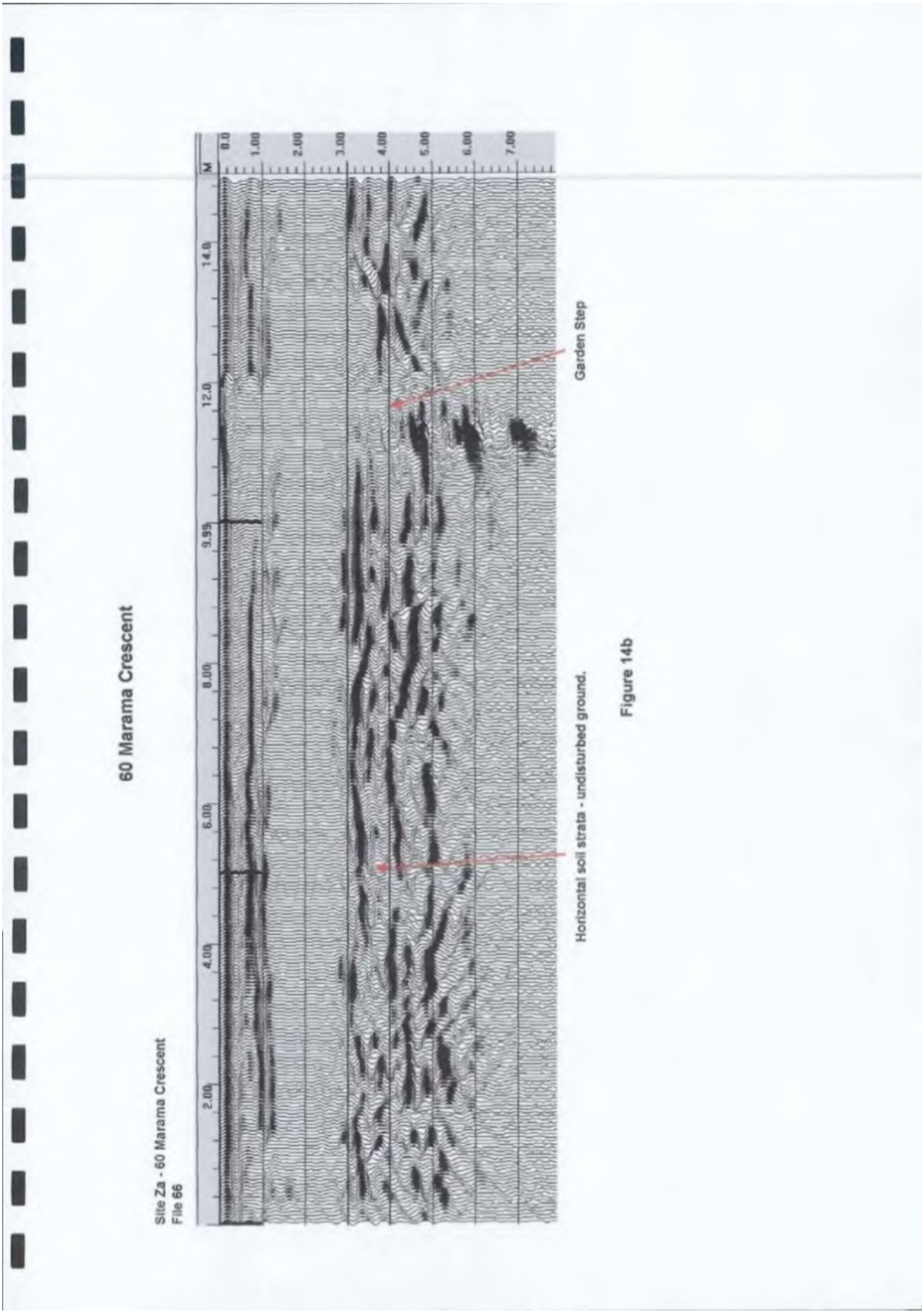

60 Marama Crescent
Site Za - 60 Marama Crescent
File 66
Garden Step
Horizontal soil strata - undisturbed ground.

Figure 14b

TRC Site Ze – Tank 3500 Centennial Drive

Location:

This site is situated on the inland side of Centennial Drive in a paddock just south of Tank 3500 of the Omata Tank Farm.

GPR Survey:

The surveyed area measured approximately 40 metres by 120 metres and included the sealed roadway between Tank 3500 and the open paddock area. GPR scan lines were taken in north to south and east to west directions at approximately five metre spacings. Refer Fig. 15a. GPR radargram file references are Files 1 through to 18 and 94 through to 96.

Three GPS positions were captured, WPs 15, 16 and 17 to record the location of this survey.

EM (Electromagnetic Induction) survey:

EM data was collected in an east to west direction over the same grid as the GPR survey with lines at approximately five metre spacings.

Data Results:

GPR data collected from this site showed an anomalous area consistent with a profile of a large excavation or filled depression extending around 55 metres in length, 20 metres width and a maximum depth of around three metres. Strong reflections can be seen at the bottom of this area indicating possible foreign material and/or suspected metal, perhaps the remains of steel drums. Also seen in the apparent area are some diffractions indicating the presence of a few large objects. Refer Fig 15b.

The EM data showed no significant change to soil electrical conductivity values in the quadrature response. The in-phase response, however, normally affected primarily by the magnetic field strength, indicates a large anomaly in the vicinity of the detected area. This response may be due either to a significant amount of metal in this area or a material having magnetic properties. The boundary of this anomaly correlates well with the GPR edge of the area. Refer Fig. 15c.

Conclusions:

The anomalous area detected using both GPR and EM techniques appear to show a large pit containing foreign material. Further investigation of this site would be necessary to determine the nature of the material and/or objects detected in the area.

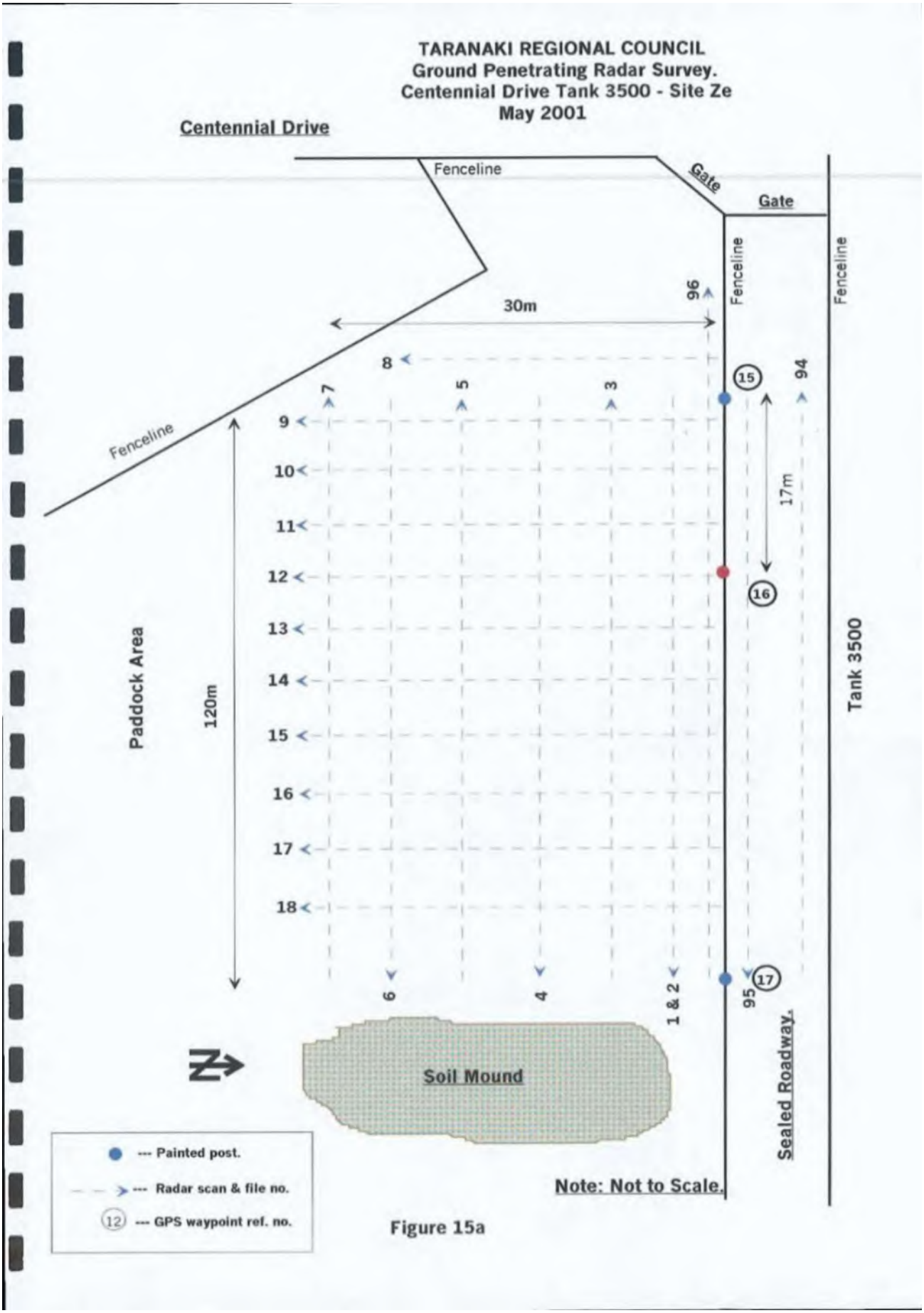

TARANAKI REGIONAL COUNCIL
Ground Penetrating Radar Survey.
Centennial Drive Tank 3500 - Site Ze
May 2001
Centennial Drive
Fenceline
Gate
Gate
Fenceline
Fenceline
96
30m
8
7
5
3
15
94
9
10
11
12
13
14
15
16
17
18
Fenceline
17m
16
Paddock Area
120m
Tank 3500
6
4
1 & 2
95
17
Soil Mound
Sealed Roadway.
Note: Not to Scale.
--- Painted post.
--- Radar scan & file no.
12 --- GPS waypoint ref. no.

Figure 15a

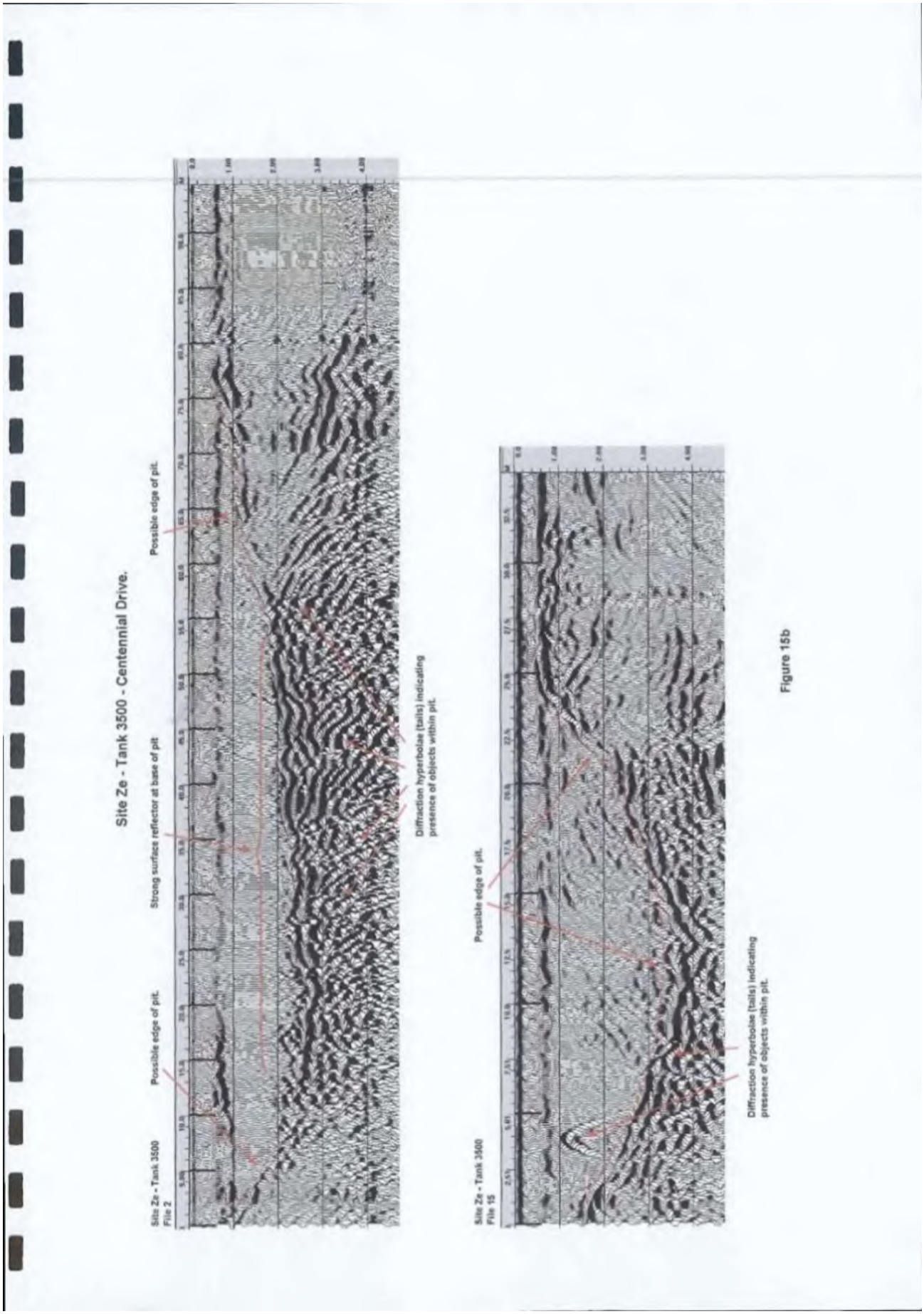

Site Ze - Tank 3500 - Centennial Drive.
Possible edge of pit.
Strong surface reflector at base of pit
Diffraction hyperbolae (tails) indicating presence of objects within pit.
Site Ze - Tank 3500
File 2
Possible edge of pit.
Possible edge of pit.
Diffraction hyperbolae (tails) indicating presence of objects within pit.
Site Ze - Tank 3500
File 15

Figure 15b

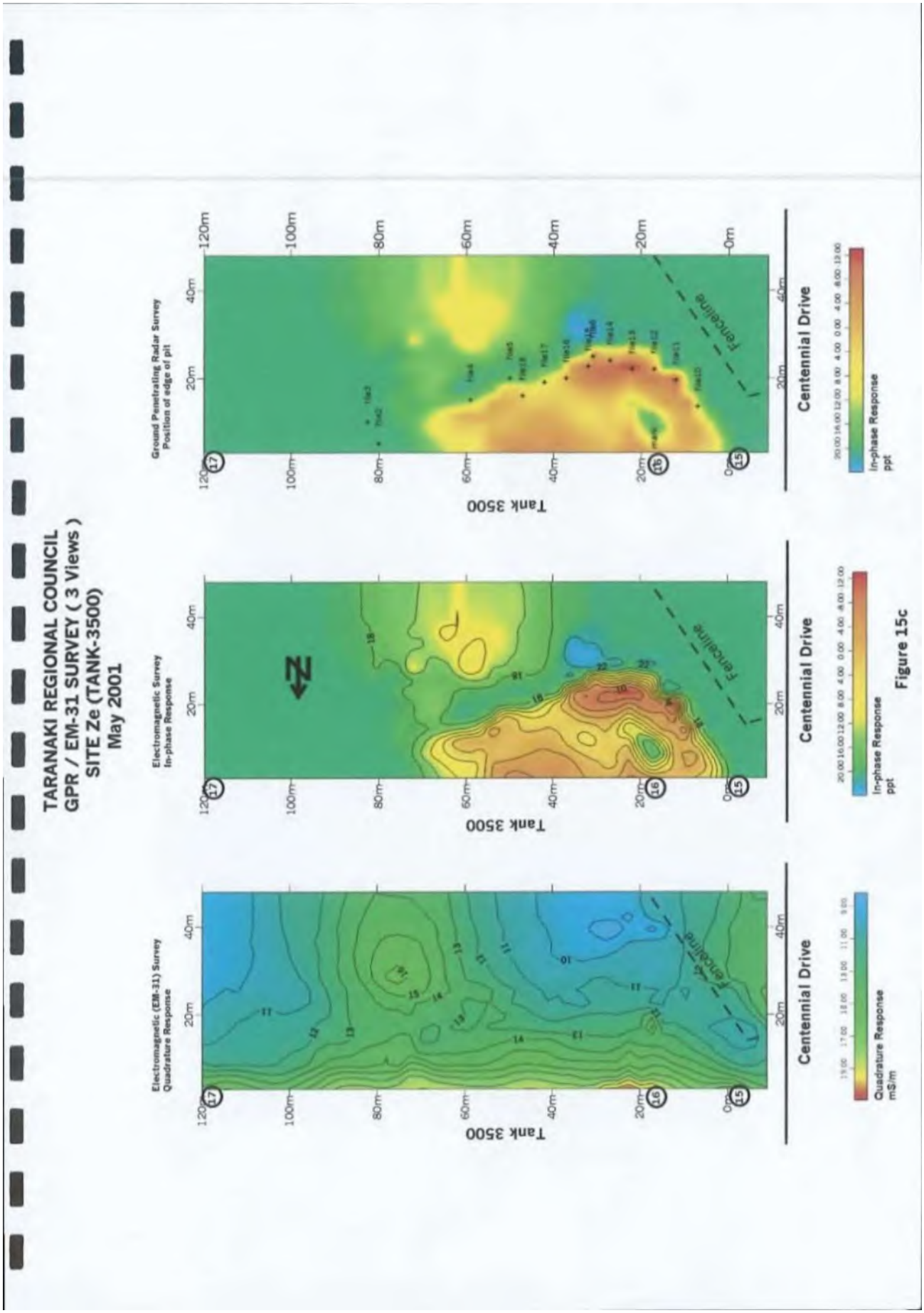

TARANAKI REGIONAL COUNCIL
GPR / EM-31 SURVEY (3 Views)
SITE Ze (TANK-3500)
May 2001
Ground Penetrating Radar Survey
Position of edge of pit
Electromagnetic Survey
In-phase Response
Electromagnetic (EM-31) Survey
Quadrature Response
Tank 3500
Centennial Drive
Fenceline
In-phase Response
ppt
Quadrature Response
mS/m
N

Figure 15c

Pylon 4 – Centennial Drive

Location:

This site is situated on the seaward side of Centennial Drive in the vicinity of Transpower pylon No 4. It consists of a grassed raised knob of land covering an area approximately 30 metres by 30 metres.

GPR Survey:

GPR scan lines were run in various directions to adequately search this site. Scan lines were run along the top of the raised knob of land, around the base and from the knob to the outlying areas. Refer Fig. 16a. GPR radargram file references are Files 110 through to 113.

GPS position WP19 was captured to record the location of this site.

Data Results:

GPR data collected from this site showed normal undulating soil strata over the majority of the area surveyed. The scan line along the top of the knob of land, however, shows two to three anomalous areas. These anomalies could be due to either large buried objects or an unusual rock formation in this area. Refer Fig 16b.

Conclusions:

Further investigation would be necessary to determine the nature of the anomalies detected.

TARANAKI REGIONAL COUNCIL
Ground Penetrating Radar Survey.
Adjacent to Pylon 4 - Off Centennial Drive.
May 2001

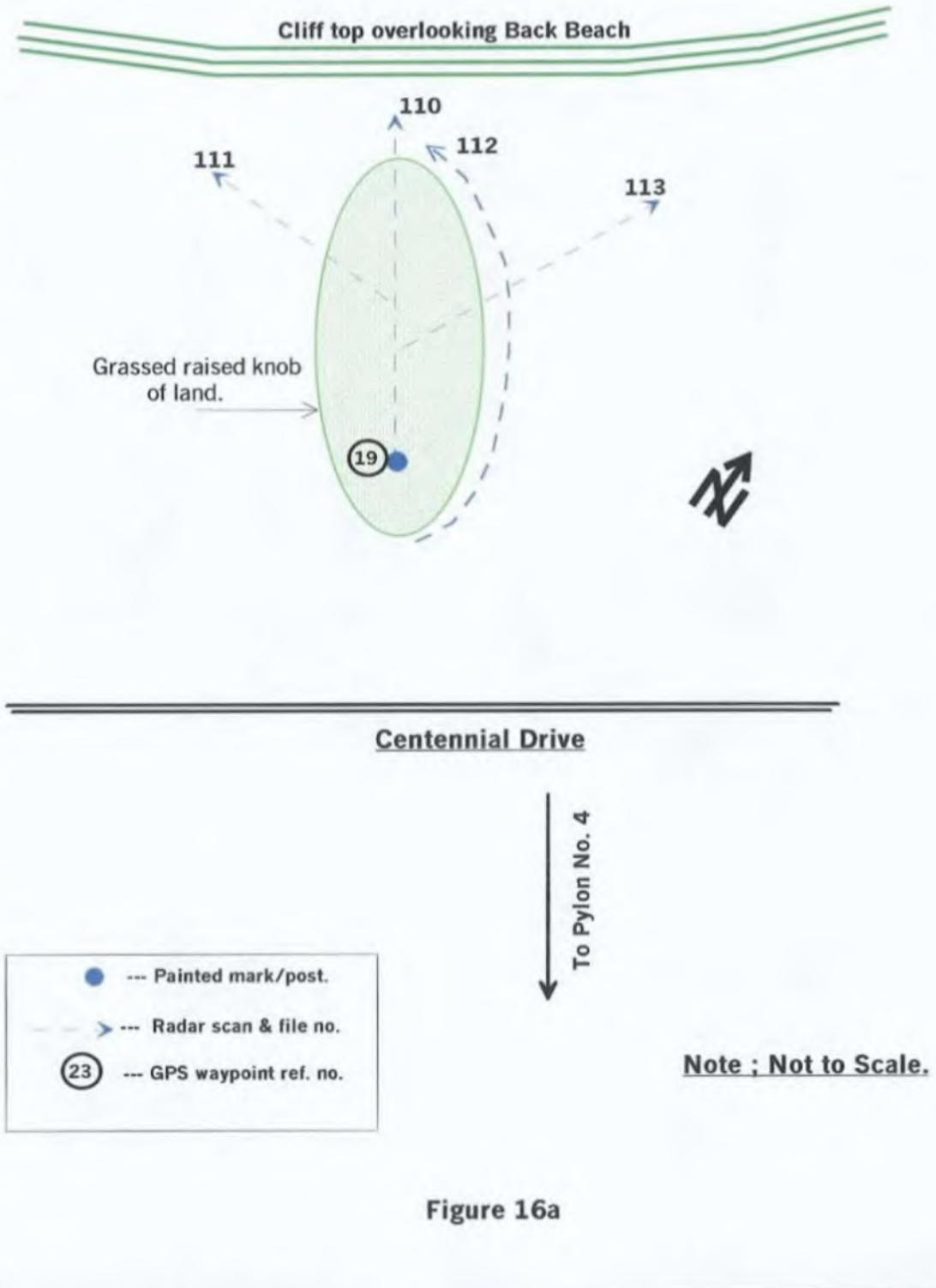


Figure 16a

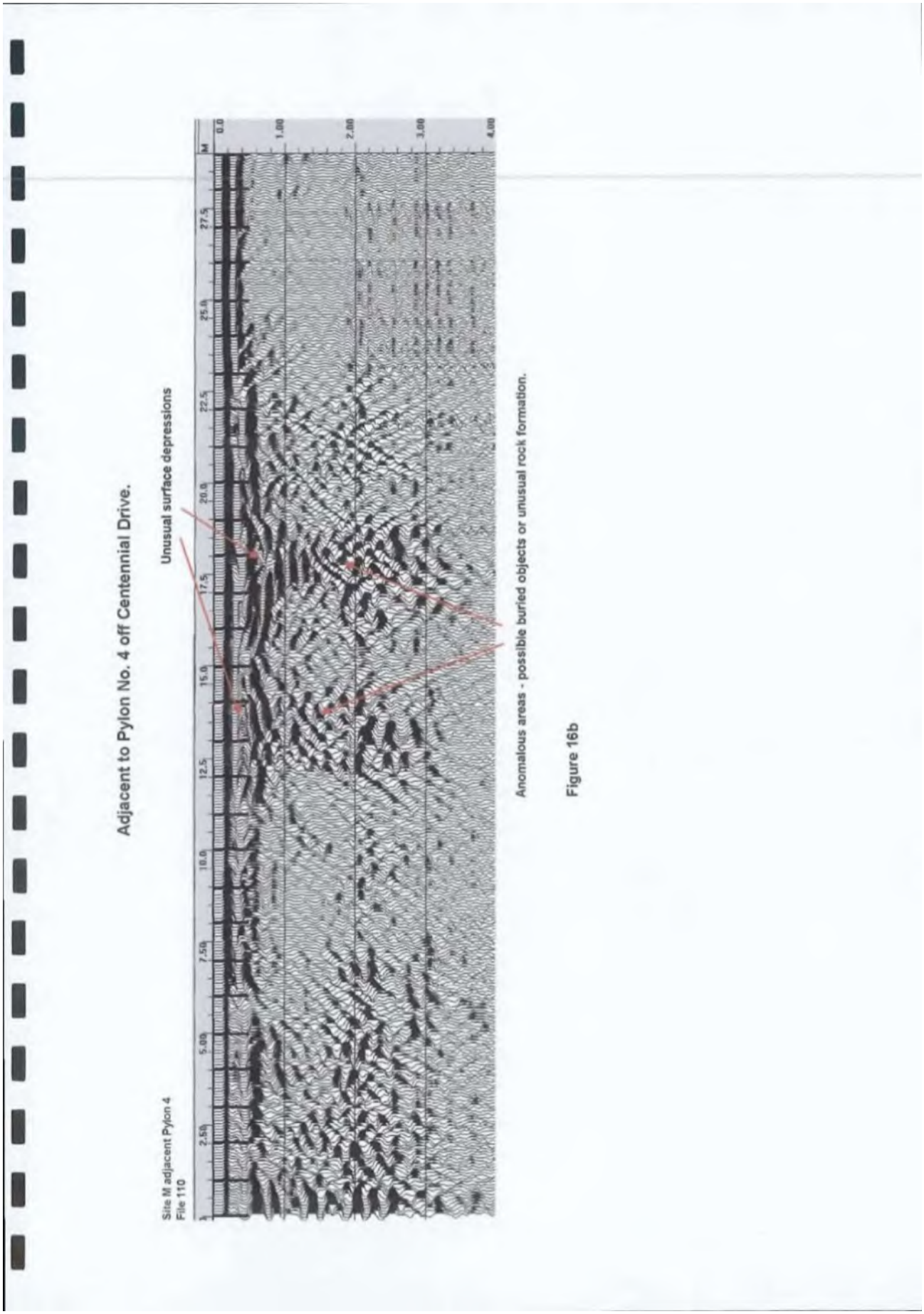

Adjacent to Pylon No. 4 off Centennial Drive.
Unusual surface depressions
Site M adjacent Pylon 4
File 110
Anomalous areas - possible buried objects or unusual rock formation.

Figure 16b

Dow AgroScience premises – Paritutu Street

Site 1 adjacent to Wellsite No 1.

Location:

This site is situated north of Wellsite No 1 and covers an area 30 metres by 50 metres approximately and is in the south-east corner of the Dow AgroScience premises.

GPR Survey:

GPR scan lines were taken in an east to west direction at approximate five metre spacings. Refer Fig. 17a. GPR radargram file references are Files 30 through to 36.

Data Results:

GPR data collected from this site showed normal undulating soil strata with no evidence of excavation or buried objects. Refer Fig 17b and Radargram File 33.

Conclusions:

All of the data collected from this site did not show evidence of a drum burial site.

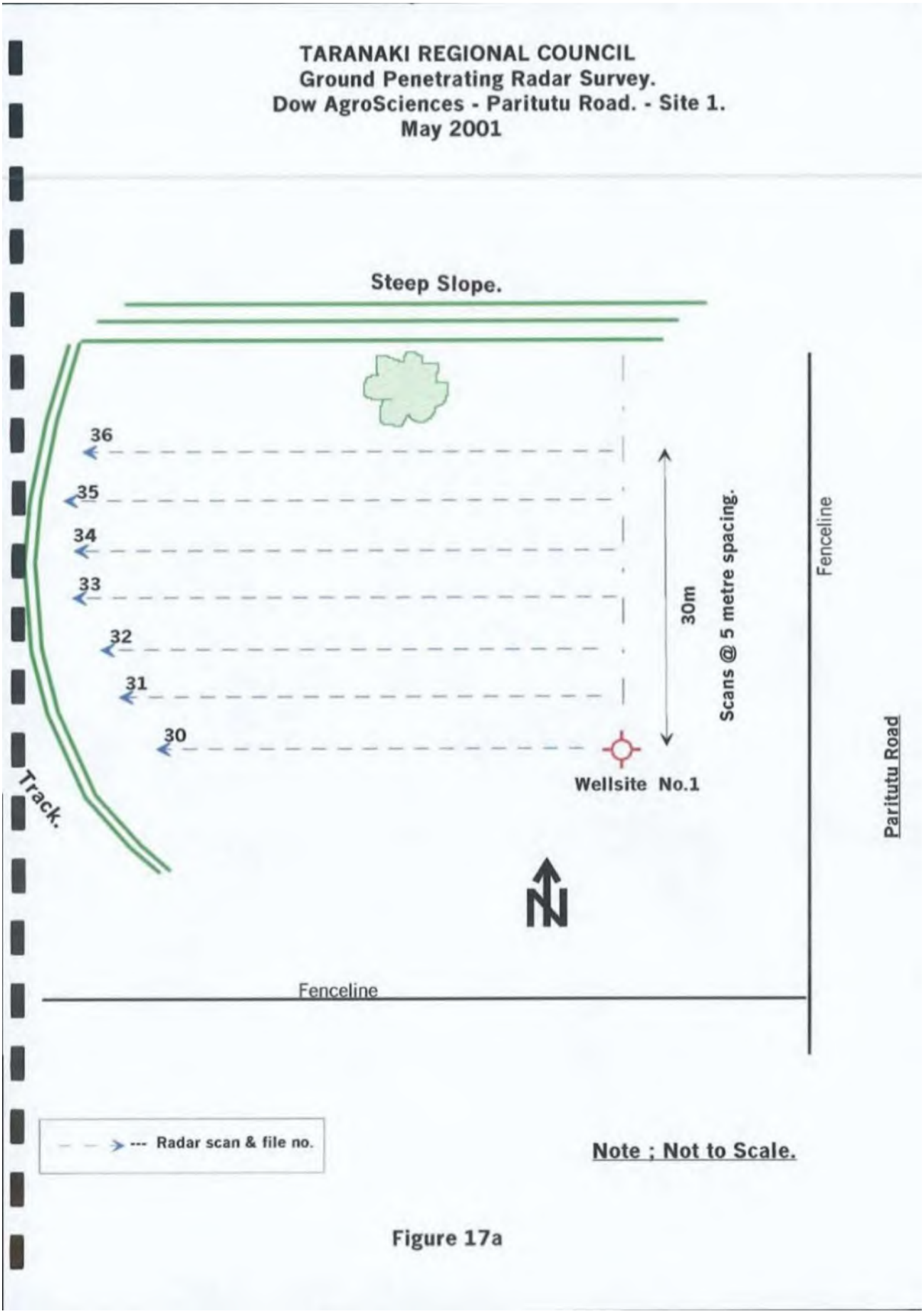

TARANAKI REGIONAL COUNCIL
Ground Penetrating Radar Survey.
Dow AgroSciences - Paritutu Road. - Site 1.
May 2001
Steep Slope.
36
35
34
33
32
31
30
30m
Scans @ 5 metre spacing.
Fenceline
Paritutu Road
Track.
Wellsite No.1
N
Fenceline
--- Radar scan & file no.
Note ; Not to Scale.

Figure 17a

Dow AgroScience Premises - Paritutu Road - New Plymouth.
Site 1 Dow AgroScience
File 33
No apparent evidence of excavation or buried objects
Site 2 Dow AgroScience
File 40
Possible excavation and buried debris (fill material) in this area

Figure 17b

Dow AgroScience premises – Paritutu Street

Site 2 adjacent to Wellsite No 4.

Location:

This site is situated adjacent and to the west of Wellsite No 4 and covers an area 30 metres by 50 metres approximately and is situated in the central section of the Dow AgroScience premises.

GPR Survey:

GPR scan lines were taken in an east to west direction at approximate five metre spacings. Refer Fig. 18a. GPR radargram file references are Files 37 through to 43.

Data Results:

GPR data collected from this site showed normal undulating soil strata for the majority of the area surveyed. There is a detected area which shows possible excavation and buried debris or fill material over an area of approximately 15 metres by 15 metres. No evidence was seen of large buried objects however. Refer Fig 17b and Radargram File 40.

Conclusions:

All of the data collected from this site did not show evidence of a drum burial site.

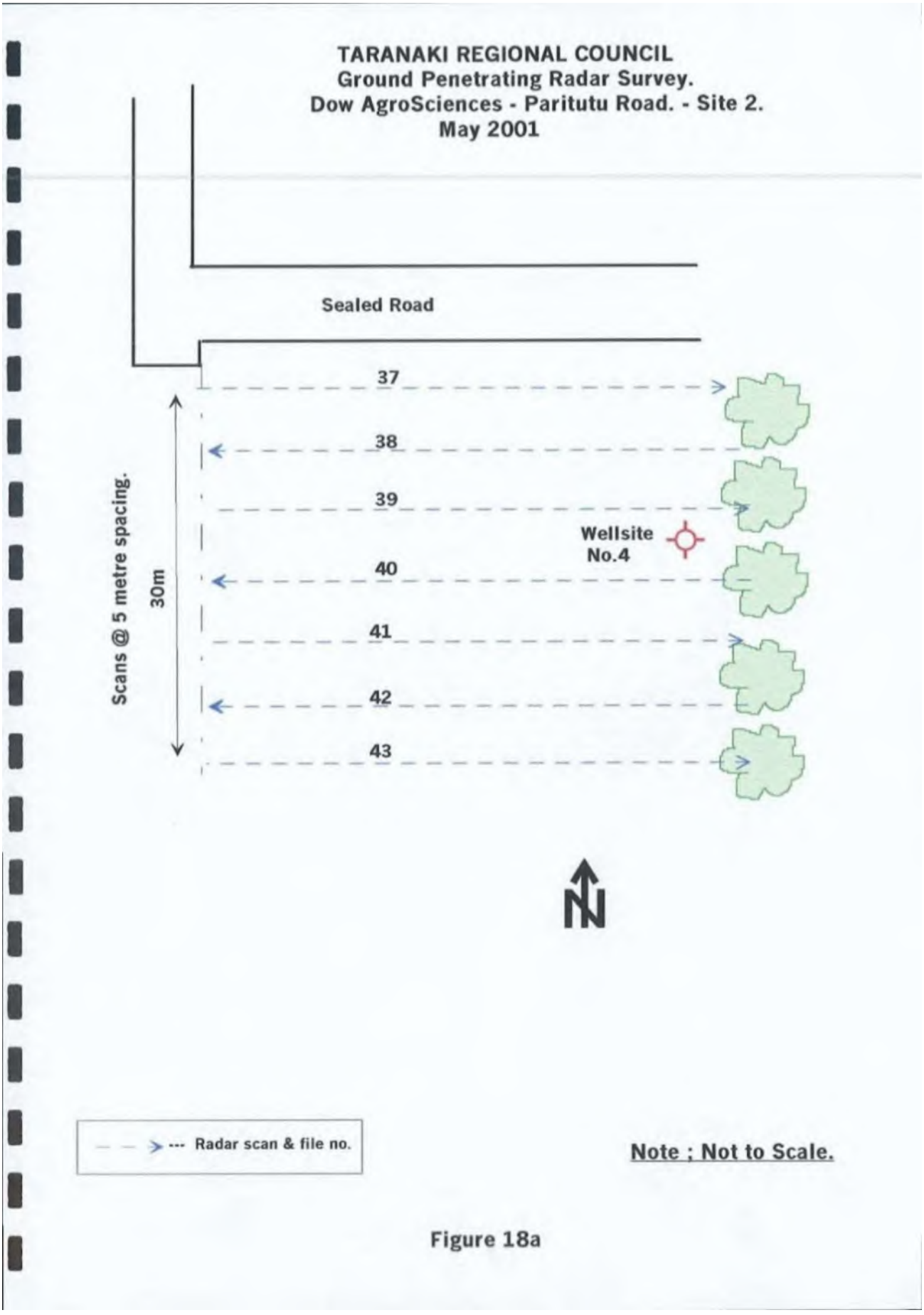

TARANAKI REGIONAL COUNCIL
Ground Penetrating Radar Survey.
Dow AgroSciences - Paritutu Road. - Site 2.
May 2001
Sealed Road
37
38
39
40
41
42
43
Wellsite
No.4
Scans @ 5 metre spacing.
30m
N
--- Radar scan & file no.
Note ; Not to Scale.

Figure 18a

Dow AgroScience premises – Paritutu Street

Site 3 adjacent to Wellsites Nos 6 and 43.

Location:

This site is situated between Wellsite No 6 and Wellsite No 43 and covers an area 70 metres by 70 metres approximately and is on the western side of the Dow AgroScience premises.

GPR Survey:

GPR scan lines were taken in an east to west direction at approximate five metre spacings. Refer Fig. 19a. GPR radargram file references are Files 44 through to 58.

Data Results:

GPR data collected from this site showed normal undulating soil strata together with an interesting underlying rock formation. Refer Fig. 19b and Radargram File 53 and 57.

Conclusions:

All of the data collected from this site did not show evidence of a drum burial site.

TARANAKI REGIONAL COUNCIL
Ground Penetrating Radar Survey.
Dow AgroSciences - Paritutu Road. - Site 3.
May 2001

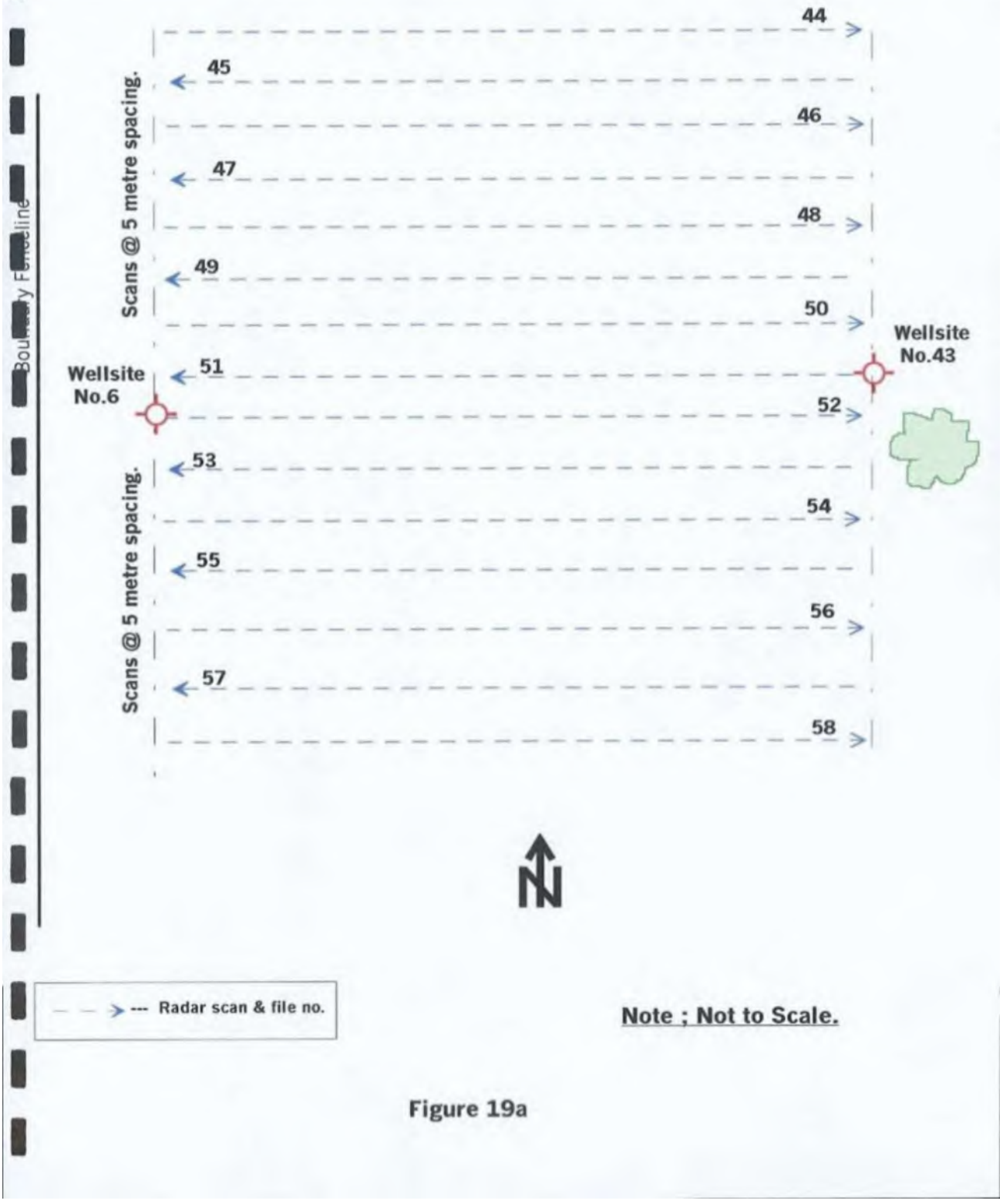
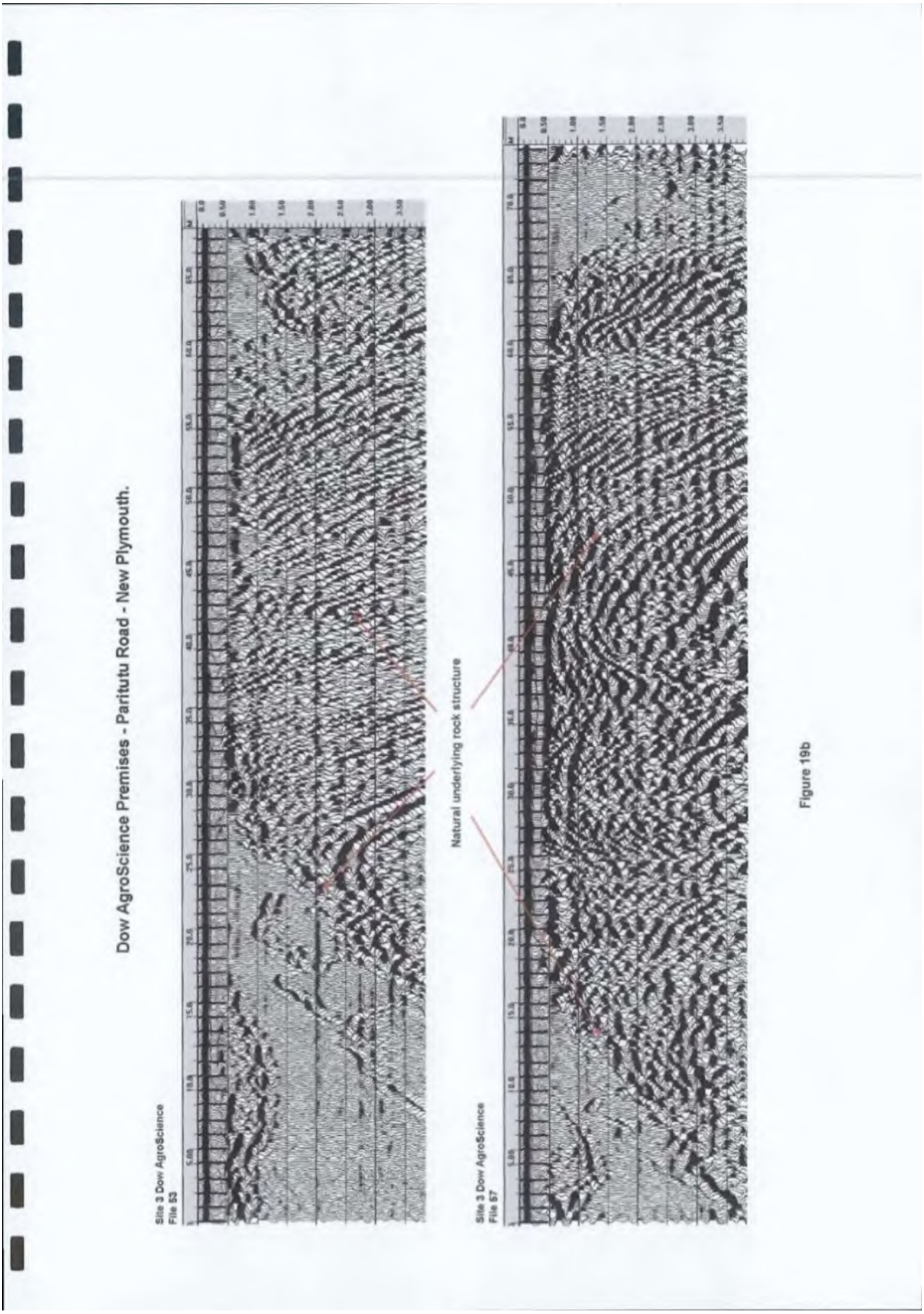


Figure 19a


Dow AgroScience Premises - Paritutu Road - New Plymouth.
Site 3 Dow AgroScience File 53
Site 3 Dow AgroScience File 57
Natural underlying rock structure
Figure 19b

Taranaki Regional Council

Appendix A

GPS Waypoints (WP)
May-01

WP	Easting	Northing	Elevation (m)
"wp01"	2600716.813	6237184.376	24.004
"wp02"	2600655.654	6237145.277	23.955
"wp03"	2600648.474	6237108.863	24.318
"wp04"	2600650.809	6237083.623	21.673
"wp05"	2598533.323,	6237594.056,	47.836,
"wp06"	2598614.056,	6237664.256,	47.821,
"wp07"	2598463.988,	6237553.395,	45.044,
"wp08"	2598412.517,	6237539.994,	39.722,
"wp09"	2598475.561,	6237671.869,	36.707,
"wp10"	2598480.288,	6237493.285,	46.901,
"wp11"	2598545.538	6236606.539	16.817
"wp12"	2598487.75	6236720.99	11.778
"wp13"	2600787.111	6234770.833	57.446
"wp14"	2600754.043	6234731.078	62.663
"wp15"	2597876.072	6235984.153	47.344
"wp16"	2597887.225	6235970.848	47.647
"wp17"	2597954.593	6235891.162	48.725
"wp18"	2598050.789	6235125.89	66.356
"wp19"	2598421.773,	6237257.011,	46.362,
"wp20"	2597696.408	6235509.427	50.654
"wp25"	2598430.768	6236658.568	21.176
"wp26"	2597594.017	6235344.729	34.395
"wp27"	2598389.185	6237067.578	31.515

Appendix V

Record of sampling action

The following notes describe the soil, sediment, leachate and water sampling undertaken as part of this investigation by John Williams (Laboratory Manager, Taranaki Regional Council, and Glenn Stevens (Scientific officer-geohydrologist). Sampling was undertaken in accordance with the protocols developed by the Council and attached to this report as Appendix III.

At least two representatives from the local Dioxin Investigation Action Group (DIAG) were present at all times during the sampling. Paddy Burt attended all sampling, with Ted Burroughs at the majority of the sites. Other representatives from DIAG were present on various occasions as well.

Field sketches and photographs were taken at each site detailing specific locations of the sampling. These records are held by the Council.

Sites A and B. Lawry Street/Seaview Road

A water and sediment sample was collected from the Mangaotuku Stream immediately downstream of the site

The water sample (4007) was collected from mid-stream and below the water surface directly into a 1 L glass bottle with a teflon lined lid. A fresh had occurred in the stream as a result of rainfall the preceding night, however the flow had largely receded by the time of sampling.

A stream sediment sample (4006) was collected directly from the stream bed. A number of scoops were collected with a 100 mL glass jar and a sampling pole and placed into a 1 L glass jar with an aluminium foil lined plastic lid. Excess water was decanted.

Composite soil samples were collected from adjacent to Devon Street West and Lawry Street (4005) and Seaview Road (4008). Both soil samples comprised of a number of soil plugs collected with a 25mm diameter 75 mm long soil corer into a glass 1 L jar with an aluminium foil lined plastic lid. The soil sample from adjacent to Lawry Street and Devon Street West comprised of six soil plugs and the sample from adjacent Seaview Road comprised of four soil plugs.

All sampling equipment and containers had been pre-cleaned prior to sampling as per the sampling protocols.

Site C. Pylon 3

Sampling at this site consisted of a composite surface soil sample from adjacent and below Pylon 3 with the remaining samples all collected from the beach cliff face (the down gradient part of the site). These sample sites comprised all the seepage points that were identified by an inspection undertaken by Inspectorate staff.

The composite surface soil sample (4058) was collected from beneath and adjacent to Pylon 3. The location of the soil sample was specified by Mr Andrew Gibbs of DIAG, and was intended to sample surface soil that had been undisturbed, at least since the pylons had been constructed. Aerial photos show the pylons being constructed in 1970.

The composite soil sample comprised of six soil plugs collected with a 25mm diameter 75 mm long soil corer into a glass 1 L jars with an aluminium foil lined plastic lids.

Vegetation, typically long grass and gorse, and the top 25 to 30 mm of soil was removed with a spade and a stainless steel trowel prior to collecting the soil plugs.

A sediment sample (4031) was collected from below a small seep adjacent to the Back Beach access track, approximately 50 m from where the track reaches the beach. The sample was collected from immediately below the seep with a stainless steel trowel and placed into a 1 L glass jar with an aluminium foil lined plastic lid.

A sediment sample (4032) was collected from below a small seep on the coastal cliff face below Pylon 3. The sample was collected from immediately below the seep with a stainless steel trowel and placed into a 1 L glass jar with an aluminium foil lined plastic lid.

A sample (4030) was collected of sediment from the invert of a pipe that discharges near the top of the beach access track below Pylon 3. The sample was collected directly from the pipe with a stainless steel trowel and placed into a 1 L glass jar with an aluminium foil lined plastic lid. There was no discharge from the pipe at the time of sampling. It is unclear where the pipe connects to.

All sampling equipment and containers had been pre-cleaned prior to sampling as per the sampling protocols.

D and P. Residential properties – Rangitake Drive

There are a number of residential properties along Rangitake Drive that back on to the Herekawe Stream. These properties are part of a subdivision that was undertaken in the mid 1970's. It is alleged that drums of contaminated wastes were disposed in the vicinity of these properties during the construction of the subdivision and building sites.

Aerial photographs taken prior to the construction of the residential subdivision show a gully extending from the Herekawe Stream up to the IWD site. This gully has been filled in with the construction of the subdivision. It is assumed that stormwater is now piped and discharges via the outfall to the Herekawe Stream approximately below 38 Rangitake Drive. (Roading chip is present in the outfall indicating stormwater from at least the road gutters discharges to the Herekawe Stream via the outfall).

26A Rangitake Drive

There are three small seepage zones on the lower grassed terrace at the rear of the section. There are reeds growing around these seepage zones. Iron oxide staining is present around these seepage zones.

Aerial photographs indicated that prior to the construction of the residential subdivision in the gully above, a stream draining from the vicinity of the IWD site flowed down the northern side of the property. There is a drainage channel/ditch that correlates to the area where the small stream is originally shown joining the Herekawe Stream on the aerial photographs.

A composite surface soil sample (4045) was collected from grassed terraces at the rear of the section. The sample comprised of six soil plugs collected with a 25mm diameter 75 mm long soil corer into a glass 1 L jar with an aluminium foil lined plastic lid.

A composite sediment sample (4044) of iron oxide stained sediments from below the three seepage zones on the lower grassed terrace was collected with a stainless steel trowel and placed into a 1 L glass jar with an aluminium foil lined plastic lid.

A sediment sample (4047) was collected from an area of iron oxide staining in a drainage channel/ditch in the north-western corner of the section. Some "nova-flow" drainage pipe discharges at the base of the channel. The sample was collected with a stainless steel trowel and placed into a 1 L glass jar with an aluminium foil lined plastic lid.

A stream sediment sample (4046) was collected directly from the streambed approximately 30 m downstream of 26A Rangitake Drive. The sample was collected with a 200 mL glass jar and sampling pole into a 1 L glass jar with an aluminium foil lined plastic lid.

All sampling equipment and containers had been pre-cleaned prior to sampling as per the sampling protocols.

32 Rangitake Drive

A composite sediment sample (4050) was collected from damp areas of soil underneath vegetation, possibly representing seeps, on the steep bank by the Herekawe Stream. A composite sediment sample from five locations was collected with a stainless steel trowel and placed into a 1 L glass jar with an aluminium foil lined plastic lid.

All sampling equipment and containers had been pre-cleaned prior to sampling as per the sampling protocols.

34 Rangitake Drive

A composite surface soil sample (4049) was collected from the lower grassed terrace at the rear of the section. The sample comprised of six soil plugs collected with a 25mm diameter 75 mm long soil corer into a glass 1 L jar with an aluminium foil lined plastic lid.

A soil/sediment sample (4051) was collected from a possible seepage zone at rear of section and approximately 1.0 m from Herekawe Stream. An iron oxide precipitate "slick" was observed immediately below this area on the Herekawe Stream. The vegetation was cleared with a spade and the sample collected with a stainless steel trowel into a glass 1 L jar with an aluminium foil lined plastic lid.

A sediment sample (4052) from the Herekawe Stream was collected from approximately 15 m downstream of the stormwater outfall and below the boundary of 34 and 36 Rangitake Drive. The sample was collected with a 200 mL glass jar and sampling pole into a 1 L glass jar with an aluminium foil lined plastic lid.

All sampling equipment and containers had been pre-cleaned prior to sampling as per the sampling protocols.

44 Rangitake Drive

A composite surface soil sample (4060) was collected from this section. The location of this soil sample was specified by Mr Andrew Gibbs of DIAG, and its purpose was to sample surface soil that had been undisturbed, at least since the establishment of the subdivision in the mid 1970's. The sample comprised of six soil plugs collected with a 25mm diameter 75 mm long soil corer into a glass 1 L jars with an aluminium foil lined plastic lids. The vegetation and the top 25 to 30 mm of soil was removed with a spade and a stainless steel trowel prior to collecting the soil plugs.

All sampling equipment and containers had been pre-cleaned prior to sampling as per the sampling protocols.

G. Marfell Park

A water sample (Reference number 4000) was collected from the leachate pipe directly into a 1 L glass bottle with a teflon lined lid.

A sediment sample (4002) was collected from immediately below the discharge pipe with a stainless steel trowel and placed in a glass jar with an aluminium foil lined lid. The sediment was collected from above the water level present in the Mangaotuku Stream at the time.

A water sample (4001)was collected from the Mangaotuku Stream approximately 50 m downstream of the discharge pipe. The sample was collected from mid-stream and below the water surface directly into a 1 L glass bottle with a teflon lined lid. A fresh had occurred in the stream as a result of rainfall the preceding night, however the flow had largely receded by the time of sampling.

Concerns were raised about iron oxide staining present on the concrete footpath at the corner of Endeavour and Grenville streets. This site is approximately 400 m north-northwest from the landfill site, and as such is close to the down gradient direction (difficult to tell as much of the topography has been modified and/or is obscured by houses).

A soil sample (4057) was collected from corner of Endeavour and Grenville streets with a stainless steel trowel into a glass jar with an aluminium foil lined lid. Site constraints were such that the sample was collected from within 5 m of a wooden fence (possibly creosote stained) and the road.

All sampling equipment and containers had been pre-cleaned prior to sampling as per the sampling protocols.

H and I. Ngamotu Domain/Squire Place

The landfill site is on the western side of a gully formed by the Mangahererangi Stream. Adjacent to the landfill site the Mangahererangi Stream comprises a swamp/wetland area. There are two culverted earth crossings, one near the top of the landfill area and the other below. The upper crossing is immediately down gradient of the Squire Place site.

Water and sediment samples were collected from adjacent to each of these culverted crossings. A third sediment sample was collected from the true left of the

swamp/wetland area and approximately 10 m downstream of a pipe located adjacent to a steep bank that separates the sports fields from the archery lawn. The pipe is assumed to be for stormwater however this has not been confirmed. There was no discharge from the pipe at the time of sampling.

The water samples (4003 and 4022) were collected from mid-stream and below the water surface directly into 1 L glass bottles with a teflon lined lids.

The sediment samples (4004, 4023 and 4024) were collected with a pre-cleaned stainless steel trowel and placed in a glass jars with an aluminium foil lined lids.

All sampling equipment and containers had been pre-cleaned prior to sampling as per the
sampling protocols.

J. Belt Road

A composite surface soil sample (4026) was collected from above the alleged location of the trench. The sample comprised of six soil plugs collected with a 25mm diameter 75 mm long soil corer into a glass 1 L jar with an aluminium foil lined plastic lid.

Following further discussion with members of DIAG, a second composite soil sample was collected from a small grassed depression adjacent to where the fill material had been placed. The sample comprised of six soil plugs collected with a 25mm diameter 75 mm long soil corer into a glass 1 L jar with an aluminium foil lined plastic lid.

All sampling equipment and containers had been pre-cleaned prior to sampling as per the sampling protocols.

L. Tahurangi Place

A composite soil sample (4043) was collected from along the rear (up gradient) boundary of the site. By necessity the composites were collected from within 5 m of a fence and, in some cases, old car tyre retaining walls. The sample comprised of six soil plugs collected with a 25mm diameter 75 mm long soil corer into a glass 1 L jar with an aluminium foil lined plastic lid.

A composite soil sample (4054) was collected from below the house. These soils were considered to most likely represent surface soils at the property that had not been modified as a result of the landscaping of the section. The sample comprised of six soil plugs collected with a 25mm diameter 75 mm long soil corer into a glass 1 L jar with an aluminium foil lined plastic lid. The cores were taken at points furthest from the tanalised wood foundation posts as possible.

All sampling equipment and containers had been pre-cleaned prior to sampling as per the sampling protocols.

M. Beach Road – 1

A composite soil sample from the alleged site and a sediment sample from the adjacent wetland area were collected.

The composite soil sample (4009) was collected from a sloping grassed area immediately up gradient of a farm track. Six soil plugs were collected with a 25mm diameter 75 mm long soil corer into a glass 1 L jar with an aluminium foil lined plastic lid.

The sediment sample (4010) was collected from the wetland area adjacent to, and down gradient of, the alleged disposal site. The sediment sample was collected from 0.2 m below ground level with a stainless steel trowel and placed in a glass jar with an aluminium foil lined lid.

All sampling equipment and containers had been pre-cleaned prior to sampling as per the sampling protocols.

P. see under D.

Q. Rifle Range Road/ Bewley Road

The river water sample (4035) was collected from the true right of the Waiwhakaiho River approximately 25 m upstream of the Mangaone Stream confluence. The sample was collected from below the water surface directly into a 1 L glass bottle with a teflon lined lid.

A number of service pipes cross the Waiwhakaiho River on a trestle opposite Vickers Road. A stormwater pipe discharges to the Waiwhakaiho River immediately upstream of the trestle. The sediment sample (4039) was collected from immediately below this stormwater pipe. There was no discharge from the pipe at the time of sampling. The composite sediment sample (4038) was collected from a seepage zone with iron oxide staining approximately 10 m upstream of this stormwater pipe. The sediment sample was collected with a stainless steel trowel and placed into a 1 L glass jar with an aluminium foil lined plastic lid.

The groundwater sample (4037) was collected from monitoring bore GND0548. This bore is located where the leachate from the Bewley Road "landfill" previously discharged. The bore is 5.1 m deep. At the time of sampling the groundwater level was 1.9 m below the standpipe rim, which is approximately at ground level. 20 L was purged using a stainless steel bailer prior to the collection of a sample in a 1 L glass bottle with a teflon lined lid.

There is a stormwater pipe with flap (to prevent back flow during a flood event) on the true right bank of Waiwhakaiho River approximately 50 m upstream of Struthers Place. The water sample (4040) of the discharge from this pipe was collected directly into a 1 L glass bottle with a teflon lined lid. The sediment sample (4041) was collected from immediately below this stormwater pipe with a stainless steel trowel and placed into a 1 L glass jar with an aluminium foil lined plastic lid.

The composite sediment sample (4042) was collected from below a seepage zone with iron oxide staining on true right bank of Waiwhakaiho River near Constance Street. The sediment sample was collected with a stainless steel trowel and placed into a 1 L glass jar with an aluminium foil lined plastic lid.

All sampling equipment and containers had been pre-cleaned prior to sampling as per the sampling protocols.

V. Centennial /2: Paritutu Gully

The water sample (4033) was collected from the remaining concrete sump at the bottom of the pipe directly into a 1 L glass bottle with a teflon lined lid.

The composite sediment sample (4034) was collected from immediately below the seeps with a stainless steel trowel and placed into a 1 L glass jar with an aluminium foil lined plastic lid.

All sampling equipment and containers had been pre-cleaned prior to sampling as per the sampling protocols.

X. Roto Street

Water and sediment samples were collected from the stream. A water sample from one of the seeps and a composite sediment sample from the seepage zone were collected. Two composite surface soil samples were also collected, one from immediately up gradient of the seepage zone and the other from near the head of the gully.

The water sample (4016) was collected from the stream immediately downstream of the site. The sample was collected using a stainless steel jug and transferred to a 1 L glass bottle with a teflon lined lid.

The stream sediment sample (4019) was collected directly from the stream bed with a stainless steel trowel into a 1 L glass jar with an aluminium foil lined plastic lid. Excess water was decanted.

The composite sample of iron oxide stained sediments (4020) was collected from below the seepage zone with a stainless steel trowel and placed into a 1 L glass jar with an aluminium foil lined plastic lid. A total of six sample points were composited.

Two composite soil samples (4016 adjacent to the seepage zone and 4021 near the head of the gully) were collected. Each sample comprised of six soil plugs collected with a 25mm diameter 75 mm long soil corer into a glass 1 L jars with an aluminium foil lined plastic lids.

All sampling equipment and containers had been pre-cleaned prior to sampling as per the sampling protocols.

Z. Ngahoro

A composite surface soil sample was collected from a sloping grassed area at, and immediately down gradient of, the site. Sediment samples were collected from the adjacent swampy/wetland areas to the north and south of the site.

The composite surface soil sample (4013) comprised of six soil plugs were collected with a 25mm diameter 75 mm long soil corer into a glass 1 L jar with an aluminium foil lined plastic lid.

The sediment samples (4014 to the north and 4015 to the south) were from 0.2 m below the surface with a stainless steel trowel and placed in a glass jar with an aluminium foil lined lid.

All sampling equipment and containers had been pre-cleaned prior to sampling as per the sampling protocols.

Site Zh. Car Park site

A composites sediment sample (4056) was collected from immediately below the seepage zone with a stainless steel trowel and placed into a 1 L glass jar with an aluminium foil lined plastic lid.

All sampling equipment and containers had been pre-cleaned prior to sampling as per the sampling protocols.

Site Zi. Pylon 4 (Herekawe cliff site)

Previous investigations at the IWD site have determined the presence of an andesite high peak or ridge under the western part of the property, with groundwater flowing to the coast around either side of the andesite high. The gully extending to the coast corresponds to the zone of groundwater flow to the south of the andesite high.

Sampling at this site consisted of a composite surface soil sample from adjacent and below Pylon 4. A water sample from the small stream and sediment samples from the top and near the base of the waterfall were also collected. No other seepage points were identified during an inspection of the area undertaken by Inspectorate staff.

The composite surface soil sample (4059) was collected from beneath and adjacent to Pylon 4. The location of the soil sample was specified by Mr Andrew Gibbs of DIAG, and its purpose was to sample surface soil that had been undisturbed for at least since the pylons had been constructed. Aerial photos show the pylons being constructed in 1970. The sample comprised six soil plugs collected with a 25mm diameter 75 mm long soil corer into a glass 1 L jars with an aluminium foil lined plastic lids. Vegetation, typically long grass and gorse, and the top 25 to 30 mm of soil was removed with a spade and a stainless steel trowel prior to collecting the soil plugs.

A water sample (4028) was collected from a small grassy pool above waterfall, approximately 30 m from cliff edge. The sample was collected directly into a 1 L glass bottle with a teflon lined lid.

A sediment sample (4029) was collected from seepage zone 2 to 3 m from the cliff edge at the top of waterfall. A composite sample was collected from the seepage zone with a stainless steel trowel and placed into a 1 L glass jar with an aluminium foil lined plastic lid.

A sediment sample (4027) was collected from the face of the waterfall, approximately 2 m above shore line with a stainless steel trowel and placed into a 1 L glass jar with an aluminium foil lined plastic lid.

All sampling equipment and containers had been pre-cleaned prior to sampling as per the sampling protocols.

Dow AgroSciences stormwater discharge to Herekawe Stream

Stormwater from the Dow AgroSciences site discharges to the Herekawe Stream from a outfall located on the true right bank of the Herekawe Stream and immediately downstream of Centennial Drive. This discharge is licensed by Resource Consent 4108.

At the time of sampling a small flow was discharging from the outfall. A water sample (4055) was collected with a stainless steel jug into a 1 L glass bottle with a teflon lined lid.

All sampling equipment and containers had been pre-cleaned prior to sampling as per the sampling protocols.

Dow AgroSciences groundwater sampling (Sites F, U, Zf, and Zg)

The Dow AgroSciences (NZ) Ltd property is located at 82 Paritutu Road, New Plymouth. In 1994 a large number of groundwater monitoring bores were installed across the site. Eight of these bores were utilised for the present investigations, two adjacent to each of 4 areas identified for further study. A map in Appendix V shows the sites and the locations of the bores.

IT Environmental (Australia) Pty Ltd were contracted to undertake the sampling of the eight bores, on 12 July 2001, under the supervision of Council staff.

On 11 July Ken Orchard of ITE, with Bruce Colgan of the Council as observer, checked and purged a number of bores using a manual bailer, to confirm their suitability for sampling the next day. The bores originally selected in the vicinity of Site Zg were found to have insufficient water for sampling; two alternatives in the same area were found.

Some bores already had positive displacement pumps in place. These were left until 12 July and purged just prior to sampling. A dedicated polyethylene bailer was left in each of the others.

Key personnel present during sampling on 12 July included Ken Orchard (ITE), John Williams (Council), Marie Gibbs (Dow AgroSciences), and Paddy Burt (DIAG).

Bores 21 (Site F), 43 (Site U), and 49A (Site Zg) were sampled using a bailer. On each successive filling, the sample was split between containers to be analysed on behalf of the Council, and retained by DIAG and the Company, respectively. These were samples 4062, 4063, and 4064. Bores 1 (Site F), 3 and 4 (Site Zf), 6 (Site U), and 46A were sampled using their dedicated air-operated pumps. They were assigned the numbers 4065,4066, 4067, 4068, and 4069 respectively.

Blanks and duplicates

A duplicate sample (4012) and four rinsate blank samples (4011, 4025, 4048 and 4061) were collected to allow quality control checks of the decontamination procedures and the laboratory analyses if required.

The rinsate blanks were collected by decontaminating the sampling equipment as per the procedures specified in the sampling protocols. De-ionised water was then poured over the particular sampling equipment and into a glass bottle with a teflon lined lid.

Sites not sampled

A residential section at Site Za 60 Marama Crescent, owned by Mr Don Sarten, was not sampled, as the geophysical survey had found no evidence of disturbed soils.

The Omata site (Site E) was not sampled, as the geophysical survey had found no evidence of disturbed soils. This site is on the opposite bank of the Herekawe Stream to the residential propertied on Rangitake Drive. The sample collected from the Herekawe Stream downstream of these sites (4046) is also a downstream sample for the Omata site.

Site	Sample			Sample date	GPS	Analyses requested			
	Type	Location	ID number			Hold	2378 TCDD	Acid herbi-cides	Organo chlorines
G. Marfell Park	Water	Leachate from pipe at discharge point into Mangaotuku Stream.	4000	6/6/01	2600373E 6236491N			*	*
	Water	Mangaotuku Stream downstream of leachate pipe.	4001	6/6/01	2600374E 6236561N	*			
	Sediment	Sediment from immediately below leachate pipe discharge point.	4002	6/6/01	2600373E 6236491N	*			
	Soil	Corner of Endeavour and Grenville streets.	4057	26/6/01				*	*
H. Ngamotu Domain	Water	Collected from immediately below culverted crossing upstream of Ngamotu site and downstream of the Squire Place site.	4003	6/6/01	2600006E 6237173N	*			
	Sediment	Collected from immediately below culverted crossing upstream of Ngamotu site and downstream of the Squire Place site.	4004	6/6/01	2600006E 6237173N		*		
	Water	Collected from channel in swamp/wetland immediately above lower culverted crossing and downstream of Ngamotu site.	4022	11/6/01	2599901E 6237279N			*	*
	Sediment	Collected from swamp/wetland immediately above lower culverted crossing and downstream of Ngamotu site.	4023	11/6/01	2599911E 6237278N	*			
	Sediment	Collected from true left of swamp/wetland approximately 10 m downstream of pipe near archery lawn.	4024	11/6/01	2599933E 6237238N	*			

Site	Sample			Sample date	GPS	Analyses requested			
	Type	Location	ID number			Hold	2378 TCDD	Acid herbi-cides	Organo chlorines
A, B. Lawry Street/ Seaview Road	Soil	Lawry Street. Composite sample of 6 soil plugs.	4005	6/6/01	2600713E 6237173N	*			
	Sediment	Sediment from Mangatuku Stream immediately downstream of the Lawry Street site	4006	6/6/01	2600710E 6237211N		*		
	Water	Mangatuku Stream immediately downstream of the Lawry Street site.	4007	6/6/01	2600710E 6237211N	*			
	Soil	Seaview Road. Composite sample of 4 soil plugs.	4008	6/6/01	2600651E 6237111N	*			
J. Belt Road	Soil	Composite sample of 6 soil plugs from on top of alleged contaminated sewage disposal trench.	4026	11/6/01	2601470E 6238026N	*			
	Soil	Composite sample of 6 soil plugs adjacent to alleged disposal area.	4043	13/6/01			*		
M. Beach Road-1	Soil	Composite sample of 6 soil plugs.	4009	7/6/01	2597595E 6235351N	*			
	Sediment	Sediment from swampy area immediately down gradient of site. Sample collected from 0.2 m below ground level.	4010	7/6/01	2597595E 6235351N		*		
Z. Ngahoro	Soil	Composite sample of 6 soil plugs.	4013	7/6/01	2597635E 6235508N	*			
	Sediment	Sediment from swampy area in gully to north of Ngahoro site. Sample collected from 0.2 m below ground level.	4014	7/6/01			*		
	Sediment	Sediment from swampy area in gully to south of Ngahoro site. Sample collected from 0.2 m below ground level.	4015	7/6/01		*			

Site	Sample			Sample date	GPS	Analyses requested			
	Type	Location	ID number			Hold	2378 TCDD	Acid herbi-cides	Organo chlorines
X. Roto Street	Soil	Soil sample from the north-east end of the site. Composite sample of 6 soil plugs.	4016	7/6/01		*			
	Soil	Soil sample from the south-west end of the site. Composite sample of 6 soil plugs.	4021	7/6/01	-	*			
	Water	Water sample collected from small stream downstream of the seepage zone.	4017	7/6/01		*			
	Sediment	Sediment collected from bed of small stream downstream of the seepage zone.	4019	7/6/01		*			
	Water	Water collected from seepage zone in bank adjacent to small stream.	4018	7/6/01				*	*
	Sediment	Sediment collected from below seepage zone adjacent to small stream. Composite sample of 6 points along seepage zone.	4020	7/6/01		*			
Q. Waiwhakaiho River/Bewley Road	Water	True right of the Waiwhakaiho River approximately 25 m upstream of the Mangaone Stream confluence	4035	13/6/01	2606845E 6239729N	*			
	Sediment	Immediately below stormwater pipe upstream of pipe trestle over Waiwhakaiho River.	4039	13/6/01				*	*
	Sediment	Composite sample from seepage zone with iron oxide staining on true right bank of Waiwhakaiho River. Approximately 10 m upstream of stormwater pipe upstream of pipe trestle over Waiwhakaiho River.	4038	13/6/01		*			

Site	Sample			Sample date	GPS	Analyses requested			
	Type	Location	ID number			Hold	2378 TCDD	Acid herbi-cides	Organo chlorines
	Ground-water	Monitoring bore GND0548 (former Bewley Road landfill).	4037	13/6/01				*	*
	Water	Discharge from stormwater pipe with flap on true right bank of Waiwhakaiho River and 50 m upstream of Struthers Place	4040	13/6/01	2606334E 6239069N	*			
	Sediment	Sediment immediately below stormwater pipe with flap on true right bank of Waiwhakaiho River and 50 m upstream of Struthers Place	4041	13/6/01	2606334E 6239069N			*	*
	Sediment	Composite sample from seepage zone with iron oxide staining on true right bank of Waiwhakaiho River near Constance Street.	4042	13/6/01	2606068E 6239038N			*	*
V. Centennial/2 Parituu Gully	Water	Concrete sump at base of old stormwater pipe.	4033	12/6/01				*	*
	Sediment	Composite sample from seepage zone with iron oxide staining north-east of old stormwater pipe.	4034	12/6/01				*	*
C. Pylon 3	Sediment	Sediment from below a small seep adjacent to the Back beach access track approximately 50 m from where track reaches beach.	4031	12/6/01				*	*
	Sediment	Sediment from below a small seep on coastal cliff face below Pylon 3	4032	12/6/01	2598362E 6237493N			*	*
	Sediment	Sediment from the invert of a pipe that discharges near the top of the beach access track below Pylon 3.	4030	12/6/01	2598396E 6237563N	*			
	Soil	Surface soils from beneath and adjacent to Pylon 3. Composite sample of 6 soil plugs.	4058	28/6/01	2598521E 6237539N		*		

Site	Sample		Sample date	GPS	Analyses requested			
	Type	Location	ID number		Hold	2378 TCDD	Acid herbi-cides	Organo chlorines
Zi. Pylon 4	Water	Collected from small grassy pool above waterfall approximately 30 m from cliff edge.	4028	12/6/01			*	*
	Sediment	Composite sediment sample collected from seepage zone 2 to 3 m from edge at top of waterfall.	4029	12/6/01	2598331E 6237135N	*		
	Sediment	Collected from face of small waterfall approximately 2 m above shore line.	4027	12/6/01		*		
	Soil	Surface soils from beneath and adjacent to Pylon 4. Composite sample of 6 soil plugs.	4059	28/6/01	2598475E 6237228N		*	
Zh. Beach access west of Herekawe Stream (below tank farm)	Sediment	Composite sample collected from immediately below seepage zone at beach end of access track.	4056	26/6/01			*	*
P. 26A Rangitake Drive	Sediment	Sediment from Herekawe Stream. Approximately 30 m downstream of 26A Rangitake Drive.	4046	21/6/01			*	*
	Soil	Surface soils from rear of section, 26A Rangitake Drive. Composite sample of 6 soil plugs.	4045	21/6/01	2598489E 6236729N	*		
	Sediment	Sediment from 3 seeps at the rear of section, 26A Rangitake Drive.	4044	21/6/01	2598489E 6236729N		*	*
	Sediment	Sediment from a seepage zone at the north-western corner of 26A Rangitake Drive.	4047	21/6/01			*	*

Site	Sample			Sample date	GPS	Analyses requested			
	Type	Location	ID number			Hold	2378 TCDD	Acid herbi-cides	Organo chlorines
D. 32 and 34 Rangitake Drive	Sediment	Soil/sediment sample from rear of section (32 Rangitake Drive) and close to Herekawe Stream. Composite of 5 samples.	4050	21/6/01				*	*
	Soil	Surface soils from rear of section, 34 Rangitake Drive. Composite sample of 6 soil plugs.	4049	21/6/01	2598521E 6236980N	*			
	Sediment	Soil/sediment sample from possible seepage zone at rear of section, below 34 Rangitake Drive and approximately 1 m from Herekawe Stream.	4051	21/6/01				*	*
	Sediment	Sediment from Herekawe Stream approximately 15 m downstream of the stormwater outfall and below 36 Rangitake Drive.	4052	21/6/01				*	*
Da. 42 and 44 Rangitake Drive	Soil	Surface soils from vacant section, 42 Rangitake Drive. Composite sample of 6 soil plugs.	4060	28/6/01	2598570E 6236617N		*		
L. 23C Tahurangi Place	Soil	Surface soils from rear boundary of section, 23C Tahurangi Place. Composite sample of 6 soil plugs.	4053	26/6/01			*	*	
	Soil	Surface soils from beneath house, 23C Tahurangi Place. Composite sample of 6 soil plugs.	4054	26/6/01			*	*	

Site	Sample			Sample date	GPS	Analyses requested			
	Type	Location	ID number			Hold	2378 TCDD	Acid herbi-cides	Organo chlorines
W. Dow AgroSciences stormwater discharge	Water	Water sample from Dow AgroSciences stormwater outfall at the mouth of the Herekawe Stream.	4055	26/6/01				*	
F. Dow AgroSciences stormwater discharge	Water	Bore 1, east of area	4065	12/7/01			*	*	
	Water	Bore 21, west of area	4062	12/7/01			*	*	
U. Dow AgroSciences stormwater discharge	Water	Bore 6, west of area	4068	12/7/01			*	*	
	Water	Bore 43, east of area	4063	12/7/01			*	*	
Zf. Dow AgroSciences stormwater discharge	Water	Bore 3, east of area	4066	12/7/01			*	*	
	Water	Bore 4, west of area	4067	12/7/01			*	*	
Zg. Dow AgroSciences stormwater discharge	Water	Bore 46A, north-west of area	4069	12/7/01			*	*	
	Water	Bore 49A, north of area	4064	12/7/01			*	*	
Blanks and duplicates	Water	Rinsate blank.	4011	7/6/01			*		
	Sediment	Duplicate of sample 4014 (Ngahoro site)	4012	7/6/01		*			
	Water	Rinsate blank – soil corer and scissors.	4025	11/6/01		*			
	Water	Rinsate blank – Stainless steel trowel.	4048	21/6/01		*			
	Water	Rinsate blank.	4061	28/6/01			*		

Appendix VI
Record of marine sampling

Filenote

Date 17 August 2001
File UIR400

Marine ecological investigation of alleged agrichemical disposal at New Plymouth

1. Introduction

A marine ecological investigation was undertaken as part of a larger Taranaki Regional Council investigation in relation to the former Ivan Watkins Dow agrichemical plant at New Plymouth and its alleged disposal of dioxin-containing by-products during the 1960's and 1970's at areas within New Plymouth.

The marine ecological investigation was undertaken to determine if any adverse effects to marine ecology around the New Plymouth coastline is evident and if any agrichemical contamination of shellfish tissue remains as a result of this alleged dumping over 30 years ago.

2. Methodology

The marine ecological investigation comprised of an inspection of intertidal reef and sandy shore biological communities, observations of individual biota, and collection of reef biota for analysis of agrichemical contamination in shellfish tissue.

A number of sites along the New Plymouth coastline and at the part of the coastline in front of the Waireka Research Station were chosen in consultation with interested parties.

The marine ecological investigation was conducted between 7 and 9 May 2001 and on 5 June 2001 during low tide periods when much of the shoreline was exposed. Most sites were able to be investigated during the 3 day period of low tides between 7 and 9 May, except the East End Beach and Ngamotu Beach sites which were able to be visited during low tide the following month on 5 June 2001.

2.1 Sites

The investigation was conducted at nine sites. Table 1 provides a description of each of the sites. The locations of the sites are depicted in Figure 1.

The five sites considered to be potential impact sites include the old Eliot Street outfall, Belt Road, Paritutu Rock, Herekawe Stream Mouth and the 'cavern' at Waireka. The Herekawe Stream Mouth site was a sandy shore site, while all others were rocky reefs. The Taranaki Regional Council has undertaken previous work at the Waireka cavern site and it is an established site recorded on the Taranaki Regional Council sites' database.

Four control sites were chosen: two sandy shore sites, East End Beach and Ngamotu Beach, and two rocky reef sites, Kawaroa Reef and Waireka South. These control sites

have similar physical characteristics to the potential impact sites but had not been exposed to any alleged discharge. The Waireka South site is an established Taranaki Regional Council site used as a control site for the Waireka cavern potential impact site.

Table 1 Description, type, purpose and location of sites

Site	Site Description	Shore type	Purpose	Grid Reference
East End Beach	Opposite East End Beach Surf Club	Sandy shore	Control	P19:046 390
Old Eliot St Outfall	At outfall	Rocky reef	Impact	P19:036 387
Kawaroa Reef	Opposite carpark & children's playground	Rocky reef	Control	P19:017 384
Belt Road	Beneath car park at end of Belt Road	Rocky reef	Impact	P19:014 381
Ngamotu Beach	Opposite public toilets	Sandy shore	Control	P19:001 377
Paritutu Rock	At base of Paritutu Rock below gully	Rocky reef	Impact	P19:985 373
Herekawe Stream Mouth	In vicinity of stream as crosses beach	Sandy shore	Impact	P19:981 369
Waireka Cavern	At cavern	Rocky reef	Impact	P19:971 353
Waireka South	Approximately 250 metes SE of cavern	Rocky reef	Control	P19:969 351

2.2 Community health

A qualitative ecological inspection at each site was undertaken to describe the number of different types of algae and macro (>3mm) animal species present (the 'diversity') and the relative numbers of individuals of each species (the 'relative abundance'). Under boulder biota was assessed where rocks and cobbles were easily overturned. This provides an overall impression of the ecological health of the intertidal community occurring at each of the potential impact sites compared to the control sites.

Each inspection involved recording the species present and their relative abundance within, approximately, 50 metres of the map grid reference given in Table 1 of each site. The inspection was undertaken prior to any disturbance to the site, such as by sample collection, and photos were taken to demonstrate marine communities occurring at each of the sites. Additional comments were recorded during each inspection with regard to substrate type, weather, odours and other matters of interest.

2.3 Individual heath

To address allegations of deformed and undersized biota, individuals of all species were observed to assess the health and quality of individuals at the potential impact sites compared to the control sites. The health of individuals was assessed according to shape and size and shell strength. Particular attention was given to any indications of abnormal morphology.

Photos were taken of species present at both potential impact and control sites.

2.4 Marine biota sample collection

During the inspections samples of marine biota were collected in order to be analysed for dioxin and acid herbicides contamination.

The preferred marine biota for any shellfish tissue analysis is the group of filter feeders. These are bivalve molluscs such as mussels and cockles, which filter very large volumes of water and act as biological filters accumulating and concentrating persistent chemicals in tissue. On this occasion, no filter feeders occurred naturally, or of sufficient abundance, at each of the sites. Other studies have obtained results from the use of gastropod molluscs for tissue analysis and as these animals were common to all sites and relatively abundant, the whelk, *Lepsiella scobina*, was chosen to indicate the presence of residual agrichemical contamination in shellfish for this investigation.

Whelks were collected at all sites for dioxin analysis. As low trace levels of acid herbicides have been recorded at the known discharge site at Waireka, whelks were also collected at the Waireka cavern and the two control sites, Waireka South and Kawaroa Reef, for acid herbicides analysis.

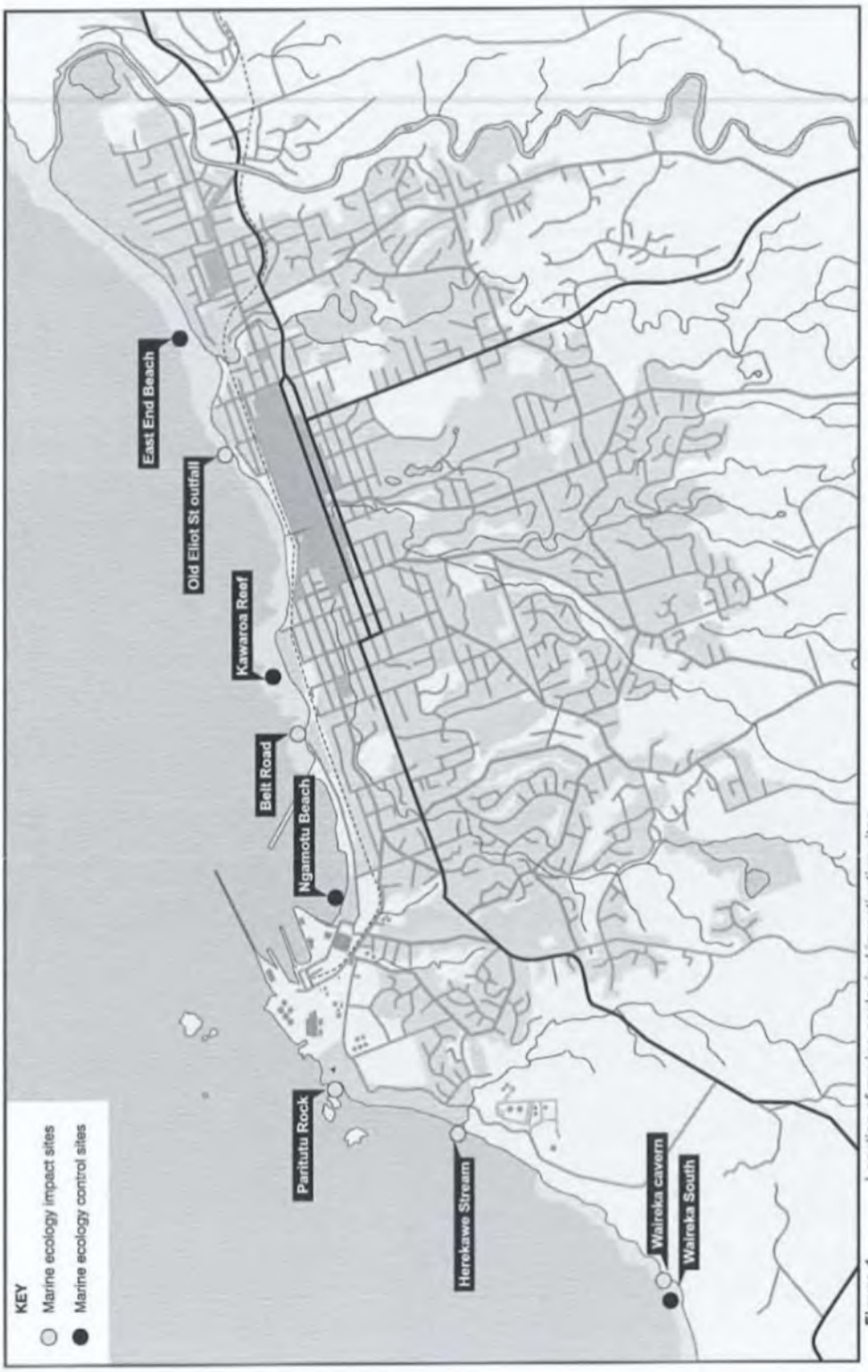


Figure 1 Location of marine ecological investigation sites

3. Results

3.1 Community health

The marine ecological inspections conducted at each site are described below. A copy of the field sheet for each site is attached as Attachment I. A copy of all photos taken at each site is attached as Attachment II.

3.1.1 East End Beach

East End Beach was inspected on 5 June 2001 at approximately 1445 hours. Low tide on this day was at 1521 hours at a height of 0.4 metres. The weather was cloudy and breezy.

East End Beach is an extensive sandy beach as depicted by photos in Attachment II. A search of marine biota within the sandy sediment was undertaken by making hand excavations at approximately 30 random locations from the mid shore to low shore height opposite the surf club. No biota was found.

3.1.2 Old Eliot Street Outfall

The old Eliot Street outfall site was inspected on 7 May 2001 at 1610 hours. Low tide on this day was at 1542 hours at a height of 0.2 metres. The weather was cloudy and breezy and there had been recent showers.

The rocky reef in the vicinity of the old outfall was one of the smaller reefs of those included in the investigation. The intertidal reef area was approximately 15 metres from high to low shore, therefore the area able to covered during the inspection was generally less than for the other reefs. It was described as a lahar platform outcrop with some large boulders. See Attachment II.

Nine algae and 25 animal species were recorded across the reef during the inspection. Each of the species recorded were common reef species found at virtually all sites along the Taranaki coastline. The dominant species included the encrusting algae, *Corrallina officinalis* paint and *Ralfsia* sp., and the barnacle, *Chaemosipho columna*, whelk, *Lepsiella scobina*, and the small topshell, *Cantharidella tesselata*. A number of species were found to be common across the outcrop. Few paua (*Haliotis iris*) and no kina (*Evechinus chloroticus*) were observed during the inspection.

3.1.3 Kawaroa Reef

Kawaroa Reef was inspected on 7 May 2001 at 1510 hours. Low tide on this day was at 1542 hours at a height of 0.2 metres. The weather was cloudy and breezy with occasional showers.

Kawaroa Reef is the largest intertidal reef along the New Plymouth coastline. The site chosen was directly opposite the carpark and playground on Tisch Avenue next to the FCE Aquatic Centre. It was described as a lahar platorm boulder reef. See Attachment II.

Nine algae and 31 animal species were recorded across the reef during the inspection. Most species were common Taranaki reef species, although some species such as the algae, *Splachnidium rugosum*, and the chiton, *Notoplax violacea*, are recorded less frequently. The barnacle, *C. columna*, and the whelk, *L. scobina*, were recorded as the most abundant species across the reef. Both the paua and kina were recorded as present and common, respectively, at this reef.

3.1.4 Belt Road

The reef opposite the carpark at the end of Belt Road was inspected on 9 May 2001 at 1705 hours. Low tide on this day was at 1701 hours at a height of 0.3 metres. The weather was partly cloudy, warm and with a slight breeze.

This reef, at the western end (toward the Lee Breakwater) of the large Kawaroa Reef, was described as lahar platform boulder/cobble reef. In comparison to the site on 'Kawaroa Reef', this section of reef comprised fewer large boulders throughout the mid shore zone. See Attachment II.

Nine algae and 23 animal species were recorded across the reef during the inspection. The algae, *Hormosira banksii* (Neptune's necklace) and the two encrusting algae, *Corralina officinalis* turf and paint and *Ralfsia* sp., dominated the reef. The barnacles, whelks, limpets and topshells were the dominant animal species. The large orange cushion star (*Stegnaster inflatus*) was recorded at this site although not commonly found during routine inspections around Taranaki. Kina was commonly found across the reef and paua were noted as present.

3.1.5 Ngamotu Beach

Ngamotu Beach, opposite the public toilets, was inspected on 5 June 2001 at 1510 hours. Low tide on this day was at 1521 hours at a height of 0.4 metres. The weather was cloudy and breezy.

Approximately 30 hand excavations of the sand at the low shore height found 3 tuatua (*Paphies subtriangulata*). See Attachment II. No other animals, or algae, were present across the beach.

3.1.6 Paritutu Gully

The small reef at the base of Paritutu Rock was inspected on 9 May 2001 at 1540 hours. Low tide on this day was at 1701 hours at a height of 0.3 metres. The weather was partly cloudy, warm and with a slight breeze. Both Taranaki Regional Council officers noted a strong 'landfill' odour at the time of the inspection.

This reef was described as a broken lahar boulder/cobble reef. See Attachment II.

Eight algae and 23 animal species were recorded across the reef during the inspection. The most conspicuous feature of this reef was the large number of anemones (*Isocradactis magna*) present. Other species that were noted as particularly abundant were the barnacles, whelks, limpets, topshells and the little black mussel (*Xenostrobus pulex*). The encrusting algae, *Corralina officinalis* paint was recorded as abundant. The topshell, *Diloma nigerrima*, was recorded as abundant which is typical of a reef receiving a freshwater flow as occurs here. Neither paua nor kina were found during an inspection of the low shore.

3.1.7 Herekawe Stream Mouth

This site was inspected on 9 June 2001 at approximately 1640 hours. Low tide on this day was at 1701 hours at a height of 0.3 metres. The weather was partly cloudy, warm and with a slight breeze.

Herekawe Stream flows across Back Beach, which is an extensive sandy beach as depicted in photos of Attachment II. A search of marine biota within the sandy sediment was undertaken by making approximately 30 hand excavations at random locations from the mid shore to low shore height in the vicinity of where the stream crosses the beach. No biota was found.

3.1.8 Waireka 'cavern'

The area of Waireka Reef about the cavern was inspected on 8 May 2001 at 1520 hours. Low tide on this day was at 1622 hours at a height of 0.2 metres. The weather was partly cloudy, mild and with a SW breeze. Both Taranaki Regional Council officers noted a mild phenoxy odour at the time of the inspection.

The cavern has been inspected by Taranaki Regional Council as part of routine monitoring for a number of years. The cavern area, including a rock pool, was inspected and the area toward low shore. The reef was described as a lahar boulder/cobble reef. See Attachment II.

Ten algae and 24 animal species were recorded across the reef during the inspection. The barnacles, limpets, topshells, whelks and the tubeworm, *Pomatoceros caruleus*, were particularly abundant at this site. Other animal species, common to Taranaki reefs, were also recorded as either common or present. The algae, paint, *Gelidium* sp., Neptune's necklace and *Halopteris* sp., were abundant. Both paua and kina were present.

Previous marine ecological inspections undertaken as routine monitoring by the Taranaki Regional Council found a similar range and abundance of species as identified in this current inspection. This previous monitoring also noted that little or no change in diversity and abundance of intertidal reef biota had occurred at this site.

3.1.9 Waireka South

The area of Waireka Reef approximately 250 metres south of the Waireka cavern site was inspected on 8 May 2001 at 1600 hours. Low tide on this day was at 1622 hours at a height of 0.2 metres. The weather was partly cloudy, mild and with a SW breeze.

This control site has been inspected by Taranaki Regional Council as part of routine monitoring for a number of years. The reef was described as a lahar boulder/cobble reef. See Attachment II.

Nine algae and 24 animal species were recorded across the reef during the inspection. The most notable feature of this site was the presence of 400-500 kina occupying a single rockpool about mid shore. Beyond the rockpool kina were recorded as common. Other abundant species included the barnacles, limpets, whelks, topshells and porcelain crab (*Petrolisthes elongatus*). The dominant algae were Neptune's necklace and *Gelidium* sp. and paint. Paua were also recorded at the site.

3.1.10 Site comparison

As a means of comparing the diversity and relative abundance of communities between each rocky reef site the field data for each site is presented in Table 2 below. This table provides information regarding the distribution of biota across all sites, the comparative abundance of biota at the sites and the comparative diversity of biota at the sites.

The abundance of species are ranked according to the description: 'Present' = 1, 'Common' = 2 and 'Abundant' = 3. Accordingly, the table presents this ranked abundance for each species at each site. It is noted that this manner of comparing between sites is not as meaningful as results collected from a full quantitative survey, and therefore these results warrant only a broad interpretation.

This qualitative assessment found that five of the 16 algae species and 10 of the 44 animal species were found at all sites. This is a total of 15 species that were widespread across all sites. Of those species found at all sites the algae *Corralina officinalis* paint, and the barnacle (*C. columna*) and whelk (*L. scobina*) were the dominant biota. A number of algae and animal species were of low abundance and confined to a few of the sites.

With regard to the ranked abundance of species at sites, the highest total abundance was recorded at the Waireka cavern site (total abundance = 68). This site was followed by the Waireka South site (total abundance = 67), Kawaroa Reef (total abundance = 66), Belt Road (total abundance = 60), Paritutu Rock (total abundance = 59) and old Eliot Street outfall (total abundance = 58).

In terms of diversity, the control site Kawaroa Reef recorded the highest number of species (40 species), followed by the old Eliot Street outfall and Waireka cavern sites (equally 34 species), control site Waireka South (33 species), Belt Road (32 species) and Paritutu Rock (31 species).

Table 2 Diversity and ranked abundance (1 = Present, 2 = Common and 3 = Abundant) of marine communities at each site

			Rocky Reef Sites						% of sites that
	Species		Waireka cavern	Waireka South	Paritutu	Belt Rd	Old Eliot St. Outfall	Kawaroa	species found in
Algae	*Carpophyllum* sp.		2	2	1	1	2	2	100
	Ceramium sp.		2	2	2	0	1	0	67
	Chaetomorpha aerea		0	0	0	0	1	0	17
	Cladophorosis herpestica		0	0	1	0	0	0	17
	Codium fragile		1	0	0	0	0	0	17
	Corralina officinalis paint		3	3	3	3	3	3	100
	Corralina officinalis turf		2	2	2	3	2	3	100
	Cystophora torulosa		0	0	0	1	0	2	33
	Gelidium caulacantheum		3	3	2	2	2	1	100
	Gigartina sp.		0	0	0	2	1	0	33
	Halopteris sp.		3	2	0	0	0	0	33
	Hormosira banksii		3	3	0	3	0	3	67
	Raffsia sp.		2	2	2	3	3	2	100
	Scytothamnus australis		2	2	2	0	0	2	67
	Splachnidium rugosum		0	0	0	2	0	2	33
	Ulva sp.		0	0	0	0	1	0	17
Animals	*Alope spinifrons*	shrimp	0	1	0	1	1	1	67
	Amaurochiton glaucus	chiton	2	2	1	1	2	2	100
	Canthandella tesselata	topshell	0	0	0	0	3	2	33
	Cellana ornata	limpet	3	3	3	3	2	1	100
	Cellana radians	limpet	3	3	3	3	2	2	100
	Chamaesipho columna	barnacle	3	3	3	3	3	3	100
	Clingfish	fish	0	1	0	1	0	0	33
	Cominella maculosa	whelk	1	1	0	0	0	1	50
	Cookia sulcata	topshell	0	0	0	0	1	1	33
	Coscinasteria calamaria	starfish	0	1	1	1	0	1	67
	Diloma nigerrima	topshell	0	0	3	0	1	0	33
	Elminius modestus	barnacle	0	0	0	0	0	1	17
	Epopella plicata	barnacle	2	2	1	1	0	0	67
	Evechinus chloroticus	kina	1	2	0	2	0	2	67
	Haliotis iris	paua	1	1	0	1	1	1	83
	Haustrum haustorium	whelk	2	2	0	1	1	1	83
	Isactinia olivacea	anemone	1	0	1	0	0	1	50
	Ischnochiton maorianus	chiton	0	0	0	2	0	0	17
	Isocradactis magna	anemone	0	0	2	0	2	0	33
	Lepsiella scobina	whelk	3	3	3	3	3	3	100
	Littorina sp.	periwinkle	1	0	0	0	0	0	17
	Melagraphia aethiops	topshell	3	3	2	3	2	2	100
	Notoacmea daedala	limpet	1	0	0	0	0	0	17
	Notoplax violacea	chiton	0	0	0	0	0	1	17
	Onchidella nigricans	limpet	1	1	2	0	2	1	83
	Pagurus sp.	crab	2	0	1	1	1	1	83
	Patelloidea corticata	limpet	0	0	0	0	1	0	17
	Patiriella regularis	starfish	0	1	0	1	0	1	50
	Perna canaliculus	mussel	0	1	0	0	0	1	33
	Petrolisthes elongatus	crab	2	3	0	2	2	2	83
	Pomatoceros caeruleus	tubeworm	3	2	1	2	2	2	100
	Plagusia capensis	crab	0	0	2	0	0	0	17
	Rainbow chiton	chiton	0	2	0	0	2	2	50
	Sabellaria kaparaensis	tubeworm	2	1	1	1	2	1	100
	Scutus breviculus	limpet	0	0	2	0	0	0	17
	Siphonaria zelandica	limpet	0	0	2	0	0	0	17
	Spirorbis sp.	tubeworm	0	0	0	0	2	1	33
	Stegnaster inflatus	starfish	0	0	0	1	0	0	17
	Stichaster australis	starfish	1	1	1	1	0	1	83
	Sypharochiton pelliserpentis	chiton	2	3	2	2	2	2	100
	Thais orbita	whelk	1	0	3	0	1	1	67
	Turbo smaragdus	topshell	2	3	1	3	1	2	100
	Xenostrobus pulex	mussel	2	0	3	0	0	2	50
	Xymene sp.	whelk	0	0	0	0	1	0	17
	Total number of species (diversity)		34	33	31	32	34	40	
	Total abundance (sum of ranks)		68	67	59	60	58	66	

3.2 Individual Health

The individual health of algae and animals, and in particular paua and kina, were assessed during each inspection of the reefs. The health of individuals was assessed according to shape and size and shell strength. Particular attention was given to any indications of abnormal morphology.

On no occasion during these inspections were any concerns noted regarding the health of individuals. All individuals at the potential impact sites exhibited similar health compared to those observed at control sites. Indeed, all individuals were no different from that observed at other reefs around the Taranaki coastline.

The Paritutu Rock site was noted as recording whelks of larger size than typically seen at the other reef sites. This site also recorded high numbers of the topshell, *Diloma nigerrima*. It is found from other monitoring around Taranaki that sites receiving a freshwater input record higher numbers of this topshell and it is expected to be the reason for high numbers at this site which receives a freshwater input from an unnamed drainage. It is not certain why whelks were found at a larger size at this site.

Examples of the many individuals observed during the inspections are attached as photos in Attachment II.

3.3 Dioxin and herbicide residues in shellfish tissue samples

3.3.1 Dioxins

Shellfish were able to be collected at each of the rocky shore sites for dioxin analysis, although no shellfish were present at the sandy shore sites (East End Beach, Ngamotu Beach and Herekawe Stream Mouth) except for three individuals of the shellfish, Tuatua, at Ngamotu Beach. Dioxin concentration was determined for shellfish collected at the rocky reef sites.

Dioxin concentrations can be expressed in total i.e., polychlorinated dibenzofurans (PCDD), and as specific congeners i.e., 2,3,7,8-tetrachlorodibenzo-*p* dioxin (TCDD). TCDD was the congener measured in the tissue of whelks, *Lepsiella scobina*, during this investigation using the method based on wet weight. This is the most toxic dioxin and the one with which other dioxins are compared to in terms of relative toxicity, referred to as the toxicity equivalent (TEQ). In this sense, TCDD can be compared to some extent to TEQ corrected PCDD concentrations.

TCDD concentrations in whelk tissue collected at New Plymouth were low at the two Waireka sites and highest at the Paritutu Rock site (Table 3). The records of analysis are presented as Attachment III.

Table 3 Results of tissue analysis for TCDD in whelks collected between 7 and 9 May 2001

Site	TCDD ng kg^{-1} (wet weight)
Control sites	
Kawaroa Reef	0.15
Waireka South	0.096
Potential Impact sites	
Old Eliot Street outfall	0.34
Waireka cavern	0.094
Paritutu Rock	1.2
Belt Road	0.13

3.3.2 Herbicides

Table 4 summarises the results of tissue analysis for acid herbicides at three sites: control site Kawaroa reef, Waireka 'cavern' and control site Waireka South. No acid herbicides were detected in shellfish at any of these sites, at the detection limit of 0.1 mg kg^{-1}. Analytical results sheets are attached as Attachment III.

Table 4 Results of acid herbicide analyses of whelk tissue collected between 7 and 9 May 2001

Acid Herbicide	Kawaroa Reef (control)	Waireka cavern	Waireka South (control)
Mecoprop	ND	ND	ND
MCPA	ND	ND	ND
Dichlorprop	ND	ND	ND
2,4-D	ND	ND	ND
Triclopyr	ND	ND	ND
MCPB	ND	ND	ND
2,4,5-T	ND	ND	ND
2,4-DB	ND	ND	ND
Bentazone	ND	ND	ND
Fenoprop	ND	ND	ND
Picloram	ND	ND	ND

ND = 'not detected' above the detection limit of 0.1 mg kg^{-1}.

4. Discussion

A marine ecological investigation was conducted to determine if any adverse effects to marine ecology exist in the vicinity of alleged former agrichemical dumpsites around New Plymouth. The investigation included descriptions of marine community health, individual biota health and residual dioxin contamination of whelk tissue at a number of sites along the New Plymouth coastline and south at Waireka. The investigation was undertaken between 7 and 9 May 2001 and 5 June 2001.

The assessment of community health found that the control site Kawaroa Reef recorded the greatest diversity of all the sites investigated. The diversity of the remaining sites, old Eliot Street outfall, Belt Road, Paritutu Rock, Waireka cavern and Waireka South, were

generally similar. The two Waireka sites and Kawaroa Reef site recorded equally high relative abundance. The abundance of the sites, old Eliot Street outfall, Belt Road and Paritutu Rock recorded similar but slightly lower levels of abundance.

In terms of being a *qualitative* assessment of ecological health it is considered that the differences between each site and between potentially impacted and control sites, are not notably large. As these inspections were single one-off inspections it is not possible to ascertain the natural variability in diversity and abundance at the sites and provide an indication of the significance of the observed differences. It is concluded that there is no discernible difference in the ecological health between each of the sites studied.

The marine biota of the Taranaki coastline have not been well documented. In relation to the New Plymouth coastline Kawaroa Reef had been previously monitored as part of another Taranaki Regional Council study (TRC, 1999) and results found this site to be the most ecologically rich compared to other New Plymouth coastal reefs studied. The most comprehensive and recent study of the interidal marine biota of North Taranaki was undertaken by Haywood *et. al.* (1999). This study found the diversity of reefs progressively increased from North Taranaki towards New Plymouth. It was noted that the shoreline becomes more sheltered and the reefs consist of a greater variety of microhabitats moving south toward New Plymouth. A second study by Haywood and Morley (unpublished) found that the intertidal biota of reefs around New Plymouth were comparable to that at Kawaroa Reef. In addition they refer to the rocky shores around New Plymouth as containing the richest and most diverse intertidal biota of the Taranaki coast. This is thought to be due to the sheltering effects of the Sugar Loaf Islands.

On no occasion during these inspections were any individuals from potential impact sites unlike those observed at the control sites. This comparison also extends to include observations at other reefs around the Taranaki coastline. All individuals were considered healthy. Other work comparing the shell strength and allometry (length-height relationship) of shellfish was undertaken by the Taranaki Regional Council in 1982. Mussels from the Eliot Street outfall site were included in this study. This study found no conclusive evidence suggesting domestic and industrial wastes from marine outfalls were impacting on mussel shell allometry and strength at the sites studied, including the site at the Eliot Street outfall (TCC, 1983). The study also found that the shell allometry of North Taranaki mussels was similar to that in other literature.

In relation to whelk tissue analysis of dioxins, the two control sites have similar TCDD concentrations to the Belt Road and Waireka cavern sites. The Old Eliot Street outfall and Paritutu Rock sites had higher TCDD levels. The most comprehensive guidelines regulating dioxins in sediments and biota for the purposes of protecting both aquatic life and human health were developed by Canada. TCDD concentrations in whelks at all control and potential impact sites were below the guideline specified in Table 5 for the human consumption of fish for PCDDs. Note that the first two guidelines (a and b) refer to the lipid weight, not the wet weight (the method used in this survey).

Table 5 Summary of available guidelines for PCDDs in estuarine and marine biota (MfE, 1999)

Guideline	Application	Country derived
a. 50 ng I-TEQ kg-1 lipid	Tissue quality objective to protect aquatic life	Canada
b. 0.66 ng I-TEQ kg-1 lipid	Tissue quality objective to protect piscivorous wildlife	Canada
c. 20 ng I-TEQ kg-1 wet weight	Limit concentration for consumption of fish by humans	Canada

A comparison of the New Plymouth dioxin concentrations with other studies in New Zealand and overseas is presented in Table 6. This comparative data must be assessed carefully. Dioxin detection methods are variable and are based on wet weight, dry weight, fat weight or lipid weight, which cannot easily be compared. In addition, most studies conducted throughout the world have been on filter-feeding bivalves. In this survey, small whelks were collected. The only data available on whelks is from a Canadian study of background levels, however, this is expressed in dry weight. As the moisture content of these whelks is not available, the wet weight cannot be accurately calculated. The dry weight dioxin concentration can be 10 times higher than the wet weight concentration, which would make the background dioxin levels in the Canadian whelks range from approximately 0.023 to 0.219 TEQ ng kg^{-1} WW. The TCDD concentrations at the New Plymouth sites were below the ranges recorded in the Canadian whelks, except at the old Eliot Street outfall and at Paritutu Rock.

Table 6 Comparison of New Plymouth results with dioxins recorded in other New Zealand shellfish and internationally (MfE, 1999)

		Shellfish	TCDD (ng kg^{-1} WW)	PCDD (total I-TEQ ng kg^{-1} WW)
New Plymouth survey				
Control site range		Whelk	0.096 – 0.15	
Potential impact site range		Whelk	0.094 – 1.2	
New Zealand		Oysters & mussels	< 0.005	0.021 (incl. ½ LOD values) 0.016 (excl. LOD values)
Hellyers Creek (upper reaches)		Oysters		0.26 (incl. ½ LOD values)
Tawarewa River mouth		Tuatuas		0.042-0.29
International				**(total TEQ ng kg^{-1} WW)**
IMW & NOAA*				ND - 3
Australia	industrial	Mussels		0.23-0.71
Japan	urban	Cockle *Fulvia mutica*		3.6
Norway	background	Mussels *Mytilus edulis*		0.1-9.6
	industrial	Mussels *Mytilus edulis*		60
USA: New York	general	Clams *Mya arenaria*		0.3-25
USA: East, Gulf and West coasts	background	Bivalves		ND – 3
				DW
Canada: St Lawrence Estuary	background	Whelks, *Buccinum undatum*		0.23-2.19
	urban	Whelks, *Buccinum undatum*		0.85-2.54

WW = wet weight; DW = dry weight; ND = non detectable; LOD = lower detection limit
* data set of bivalves by International Mussel Watch (IMW) and National Oceanographic and Atmospheric Administration (NOAA) Status and Trends Programmes.

In general, dioxin concentrations in shellfish tissue of the New Plymouth control and potential impact sites were within a similar range to the few other New Zealand studies, however the old Eliot Street outfall and Paritutu Rock site were higher. Both of these sites are still well below the Canadian guideline of 20 ng kg^{-1} I-TEQ WW. Dioxin levels in New Zealand shellfish, including the New Plymouth shellfish, are generally lower than levels recorded overseas.

Tissue analysis for acid herbicides at three sites: control site Kawaroa reef, Waireka cavern and control site Waireka South was also undertaken. No acid herbicides were detected in whelk tissue at these sites.

Since 1986 the Taranaki Regional Council has monitored the discharge from the Waireka landfill site under its annual monitoring programme. These findings have been reported annually and are publicly available. As part of this programme, the Taranaki Regional Council has conducted ongoing herbicide analyses at the Waireka Reef including in the vicinity of the cavern. Since 1990, kina on the Waireka Reef have been collected and analysed for the acid herbicides which were measured in the tissue of whelks in the current survey. On most occasions, herbicides have been very low or below the detection limits. Herbicides have not been recorded much above the detection limits since 1994.

Water samples collected on the Waireka Reef in June 2000 showed that herbicides were just above the detection limits, for the southern Waireka (control) site and below detection limits (<0.02 mg kg^{-1}) at all other sites on the Waireka Reef.

There are no guidelines or standards regulating acid herbicides, and particularly 2,4-D and 2,4,5-T, in fish or shellfish. The chlorophenoxy compounds, 2,4-D and 2,4,5-T, do not appear to significantly bioaccumulate in the tissue of animals in the aquatic environment and biomagnification along the food web is also not considered to be significant (CCREM, 1987).

These monitoring programmes have clearly established that there is no adverse impact on marine ecology in the vicinity of the Waireka landfill.

Taranaki beaches can be described as open, clean and actively moulded by waves. In addition, the high black ironsand content can cause extreme temperature shifts making conditions unfavourable for shellfish. As a result, the low abundance of shellfish at both control sites and the potential impact site on sandy beaches was not unexpected. Other observations have similarly found no or very few bivalves inhabiting sandy shores of Taranaki.

5. Conclusions

The results of this marine ecological investigation conclude that no residual effects to marine biota and communities as a result of alleged dumping of agrichemicals at New Plymouth were present at the sites investigated.

There was no discernible difference between the ecological health of marine communities at control sites and potentially impacted sites. Other marine ecological studies have found intertidal marine communities to be rich and diverse around the New Plymouth coastline.

In contrary to allegations of deformed and undersized biota at some of the alleged discharge sites, all individual biota at all of the sites investigated was found to be healthy and normal.

The whelk tissue analysis results found residual dioxin levels at the New Plymouth sites were similar to or marginally above other New Zealand studies. It should be noted that these other studies were at background sites isolated from known dioxin discharge points. Of the New Plymouth sites, the old Eliot Street outfall and Paritutu Rock recorded slightly higher levels. As noted above, the biota at both these sites showed no evidence of being in anyway affected. These sites remain well below the Canadian guideline concentration for consumption of fish by humans. Dioxin levels in various overseas shellfish can be considerably higher than recorded during this survey. The dioxin levels recorded in the New Plymouth whelks were well below results reported from the USA for both reference (background) samples and for samples from urban regions (MfE, 1999; Figure 6.1).

No acid herbicides were detected in whelk tissue at the Waireka cavern and two control sites.

This study has found no evidence of risk to either the environment or to human health in relation to the sites investigated.

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Scientific Officer (Marine Ecology)

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Attachment I

Field Sheets

no sample

Dioxin Shellfish Investigation, NP

Site: East End Beach GPS: 2604672 E, 6259048 N
Date: 5 June 2001 Sunshine Low Tide: 3:21pm 0.1m
Site Description (locality, substrate, etc):
Sandy beach. Photos
Comments: Cloudy, breezy

Population composition, diversity and abundance

Algae	Animals
no biota present	

P = present C = common A = abundant

Individual quality and health:

Other Comments:

no comments

TKC 0110/2

Dioxin Shellfish Investigation, NP

Site: Old Mill Street outfall GPS: E2603607 N6038730
Date: 7/5/01 1610 - 1640 hrs Low Tide: 3:42 pm 0.2
Site Description (locality, substrate, etc): Platform, some boulders. Site covered approx 15m area from high to low shore (very small reef/outcrop)

Comments: Small reef/lower platform outcrop.
1/8 cloud, SW moderate wind, no showers at time of sampling.
Kathryn, Wendy, Fiona

Population composition, diversity and abundance

Algae	Animals	
Carpophyllum : C	Chaemosipho : A	Haustrum P
Paint : A	Lepsiella : A	Cookia P
Gelidium : C	Patelloidea : P	Pagurus P
Ralfsia : A	Cantharidella : A	C. radians C
~~Gelidium~~ C	Xymene : P	C. ornata C
Chaetomorpha P	Isocradactis C	Onchidella C
Gigartina - P	Turbo P	Melagraphia C
Turf C	Amaurochiton C	Diloma P
Ceramium P	Petrolisthes C	Alope P
Ulva P	Pomatoceros C	Rainbow chiton C
	Sabellaria C	Sypharochiton C
	Paua P	Thais P
	Spirorbis C	Ulva.
9 Algae		25 Animals

P = present C = common A = abundant

Individual quality and health:

Nothing unusual or conspicuous to note

Paua morphology normal as for all other biota across reef. Very few paua No kina

Other Comments:

fewer boulders and small cobbles compared to Kawaka Reef

TRC 0401 1

Dioxin Shellfish Investigation, NP

Site: KAWAROA Reef GPS: ~~2760174~~ 2760174S ~~N6738405~~ N6238510

Date/Time: 7/5/01 1510hrs – 1600hrs Low Tide: 3:42 pm 0.3m

Site Description (locality, substrate, etc): Platform/boulder reef. "Site" covered approx. 40m circular area including low tidal zone.

Comments: (weather: cloud cover; wind dir/strength). Sampling team: 7/8 cloud, showery SW moderate wind. Kathryn, Wendy, Fiona

Population composition, diversity and abundance

Algae	Animals		
Hormosira banksii A	Kina C	Perna P	Paua P
Turf A	Lepsiella A	Petrolisthes C	Elminius mod
Paint A	Chaemosipho A	Amaurochiton C	
Gelidium P	Turbo C	Notoplax violacea P	
Ralfsia C	Nelagraphia C	C. ornata P	
Carpophyllum C	C. radians C	Mope P	
Splachnidium C	Zonatoceros C	Cantharidella C	
Cystophora C	Onchidella P	Rainbow chiton C	
Scytothamnus C	Sypharochiton C	Cookia sulcata P	
	Cominastrias P	Thais P	
	Patiriella P	Isochiton olivacea P	
	Xenostrobus C	Haustrum P	
	Stichaster P	Cominella maculosa P	
	Sabellaria P	Pagurus sp. P	
9 Algae	31 Animals	Spirorbsis P	

P = present C = common A = abundant

Individual quality and health:

Nothing unusual or conspicuous to note

Paua present appeared normal and strong.

All other biota appeared morphologically normal/healthy.

Other Comments:

Weigh 11 kina = 4g. = 40 grams
⇒ 50 kina = 200gm

TPC 011084

Dioxin Shellfish Investigation, NP

Site: Bell Road GPS: [illegible]
Date: 9/5/01 1105 – 1135 hrs Low Tide: 5:01 pm 0.5m
Site Description (locality, substrate, etc):
Lahar Platform / boulder/cobble reef.
Weather: 4/5 cloud, warm, slight breeze
Comments:
Sampling team: Kathryn + Fiona

Population composition, diversity and abundance

Algae	Animals	
Carpophyllum P	Lepsiella A	Coscinasterias P
Turf A	Kina C	Mope P
Hormosira A	Chaemosipho A	Sabellaria P
Paint A	Melagraphia A	lg. orange Patiriella P
Ralfsia A	Pomatoceras C	Paua P
Gelidium C	Eopepella P	Clingfish P
Cystophora P	Pagurus P	Sypharochiton C
Splachnidium C	Amaurochiton P	Petrolisthes C
Gigartina C	Ischnochiton C	Haustrum P
	Stichaster P	Stegnaster inflatus
	C. radians A	
	Turbo C/A	
	C. ornata A	
	Patiriella P	
9 Algae		23 Animals

P = present C = common A = abundant

Individual quality and health:

Photos taken of paua + kina. All appeared normal.

Other Comments:

Dioxin Shellfish Investigation, NP

Site: Ngamotu Beach GPS: [illegible]
Date: Tues 5 June 2001, 15:[illegible] Low Tide: 3:21pm 0.1m
Site Description (locality, substrate, etc):
Sandy beach. Photos. Cloudy + breezy

Comments: Ngamotu beach used as a control site for the Herekawe Stream mouth beach site

Population composition, diversity and abundance

Algae	Animals
No algae	Tuatua (3 only)

P = present C = common A = abundant

Individual quality and health:

Photos taken of tuatua Appear normal & healthy.

Other Comments:

Dug ~ 30 holes to find 3 tuatua
Photos

TRC 011033

Dioxin Shellfish Investigation, NP

Site: Paritutu Rock GPS: E2578467 N6231321
Date: 9/5/01 1540 - 1630 hrs Low Tide: 5:01 pm 0.3m
Site Description (locality, substrate, etc): Boulder / broken lahar / cobble reef
Weather: 3/8 cloud, warm, slight breeze

Comments:
Sampling Team: Kathryn + Fiona

Population composition, diversity and abundance

Algae	Animals	
Scytothamnus C	Xenostrobus A	Pomatoceros P
Paint A	Isocradactis magna C	Pagurus P
Ceramium C	Chaeniosipho A	Turbo P
Gelidium C	Melagraphia C	Stichaster P
Ralfsia C	Sypharochiton C	Isactinia P
Carpophyllum P	C. radians A	Anaurochiton P
Cladophoropsis P	Thais A	Coscinasterias P
Turf C	Diloma A	Plagusia C
	Onchidella C	Sarkis C
	Lepsiella A	
	Siphonaria C	
	Cypopella P	
	C. ornata A	
	Sabellaria P	
8 Algae	23 Animals	

P = present C = common A = abundant

Individual quality and health:

A large number of large *Lepsiella scobina* present.
Heaps anemones
No Paua found No kina

Other Comments:

Small reef
large sand lenses present
Strong 'landfill' odour

no sample

Dioxin Shellfish Investigation, NP

Site: Herekawe Stream Sea GPS: E2592072 N6236704
Date: 9/5/01 1645 hrs Low Tide: 5:01pm 0.3m
Site Description (locality, substrate, etc):
Sandy beach at river mouth.
Weather: 3/8 cloud. warm, slight breeze.
Comments: No biota present in sand
Sampling team: Kathryn + Fiona

Population composition, diversity and abundance

Algae	Animals
no biota present	no biota present

P = present C = common A = abundant

Individual quality and health:

Other Comments:

No comments.

TRC DIIC13

Dioxin Shellfish Investigation, NP

Site: WAIREKA 'Cavern' site   GPS: E2597093 N6735255 (adjacent rock pool @ cav
Date: 2/5/01 1520hrs – 1600hrs   Low Tide: 4:22 pm 0.2m
Site Description (locality, substrate, etc): Lahar/boulder/cobble reef. Site at rockpool at the of cliff at the cavern. Site covered ~ 40m area from rockpool to low shore level.

Comments: Mild phenoxy odour at time of sampling/inspection. Large sand lenses present.

Kimberley, Fiona

Population composition, diversity and abundance

Algae	Animals
Turf C	Kina P
Gelidium A	N. daedala P
Hormosira A	Cominella P
Ralfsia C	Haustrum C
Paint A	Turbo C
Ceramium C	Xenostrobus C
Carpophyllum C	Pagurus C
Scytothamnus C	Sabellaria C
Halopteris A	Chaemosipho A
Codium P	Petrolisthes C
	Zeacumantus / Lepopella C
	Amaurochiton C
	C. ornata A
	Isactinia P
	C. radians A
	Stichaster P
	Pomatoceros A
	Onchidella P
	Melagraphia A
	Paua P
	Sypharochiton C
	Lepsiella A
	Littorina P
	Thais P
10 Algae	24 Animals

P = present 1   C = common 2   A = abundant 3

Individual quality and health:

No apparent abnormalities. All individuals appear healthy and normal.

Paua had normal morphology.
Fewer paua / harder to find at this site compared to the control site. Few kina present.

Other Comments:

Panoramic photos showing landscape of cavern along to control site

NOTE: A raft using empty DAS product plastic containers was found at base of cliff between Waireka and Waiowhatoke Streams. It appeared to have been washed down Waiowhatoke Stream along with other debris.

JRC [illegible]

Dioxin Shellfish Investigation, NP

Site: WAIREKA 'Control'
GPS: E 2594932 N6235135
Date: 2/5/01 1600hrs – 1630hrs
Low Tide: 4:22pm 0.2m
Site Description (locality, substrate, etc): ~200-250m W 'cavern' @ next headland (photo) lahar/boulder/cobble reef
Comments: 4/8 cloud, SW breeze, mild

Kimberley, Fiona

Population composition, diversity and abundance

Algae	Animals	
Turf C	Chaemosipho A	Petrolisthes C/A
Hormosira A	C. ornata C/A	Patiriella P
Gelidium A	C. radrans A	Haustrum C
Paint A	Sypharochiton C	Cominella P
Ceramium C	Lepsiella A	Clingfish P
Dasysia C	Melagraphia A	Coscinasterias P
Haloptoris A/C	Rainbow chiton C	Onchidella P
Carpophyllum C	Pomatoceros C	Stichaster P
Scytothamnus C	Turbo A	Sabellaria P
	Kina C	Perna P
	Eporelia C	Paua P
	Alope P	
	Amaurochiton C	
9 Algae	24 Animals	

P = present C = common A = abundant

Individual quality and health:

All individuals appearing normal and healthy
Photos.
Paua appeared normal, strong shell.

Other Comments:

1 main rockpool in approx ~ 400 Sea Kina midshore zone

Panoramic photos showing landscape from 'cavern' to control site

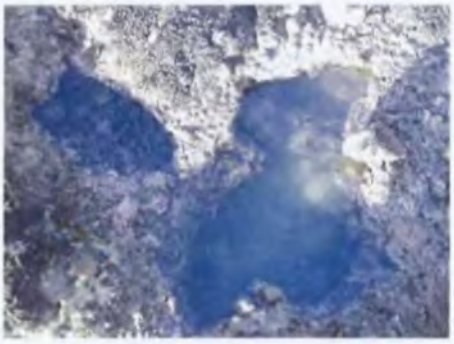
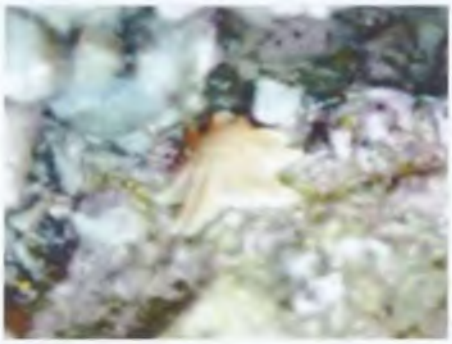
Attachment II

Site Photos

East End Beach

Old Eliot Street Outfall



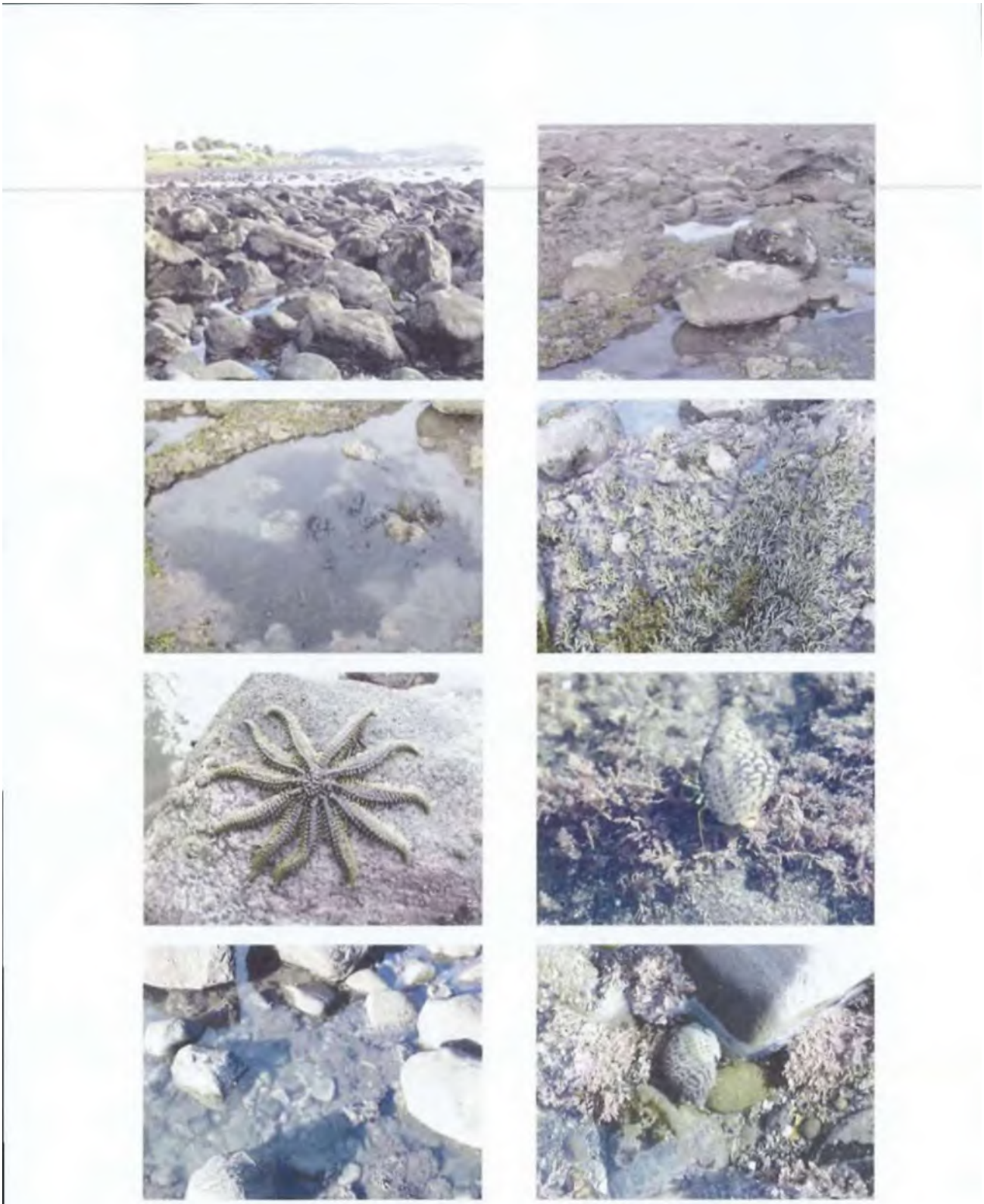




Kawaroa Reef

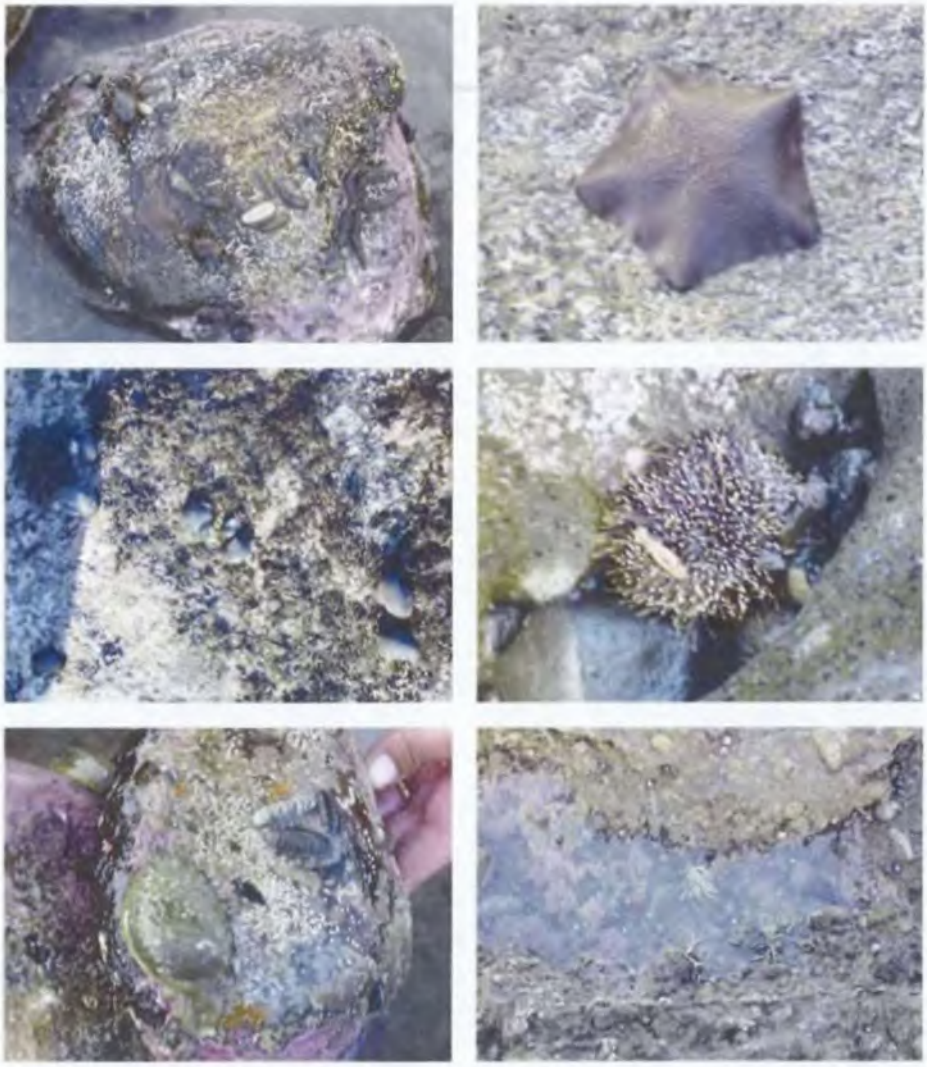






Belt Road



Ngamotu Beach




Paritutu Rock








Herekawe Stream Mouth

Waireka Cavern

Waireka South

Attachment III

Shellfish Analytical Results

10/08 '01 FRI 15:36 FAX

AgriQuality New Zealand Limited
Hu..angi Aotearoa

Gracefield Road
P.O. Box 31 242
Lower Hutt, New Zealand

Phone: +64 4 570 6800
Facsimile: +64 4 569 4500

02 August 2001

Certificate of Analysis

Client:	Taranaki Regional Council Private Bag 713 Stratford
Attention:	Fiona Putt
Date Received:	11 May 2001
Client Reference:	011011, 011013, 011014
AgriQuality Lab. Reference:	01-1932/1,3,4
Sample Type:	Shellfish
Analysis:	**Acid Herbicide**

Method:

The sample was isolated by solid phase extraction and the extract derivatised with diazomethane. Measurement was performed using gas chromatography - mass spectrometry. Full details of the methodology are available on request.

Results are reported in milligrams per kilogram (ppm).

Analytical results are for samples as received.

K. J. Lange
UltraTrace™ Laboratory
AgriQuality Environmental

M. D. Valentine
UltraTrace™ Laboratory
AgriQuality Environmental

02 August 2001

SAMPLE DETAILS	
Client Reference	011011, Kawaroa Reef, 08/05/01
AgriQuality Lab. Reference	01-1932/1

RESULTS	
Acid Herbicide	Level (mg/kg)
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 mg/kg

02 August 2001

SAMPLE DETAILS	
Client Reference	011013, Waircka 'cavern', 08/05/01
AgriQuality Lab. Reference	01-1932/3

RESULTS	
Acid Herbicide	Level (mg/kg)
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 mg/kg

02 August 2001

SAMPLE DETAILS	
Client Reference	011014, Waireka 'control', 08/05/01
AgriQuality Lab. Reference	01-1932/4

RESULTS	
Acid Herbicide	Level (mg/kg)
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 mg/kg

. 10/07 01 TUE 17:47 FAX 001

AgriQuality New Zealand Limited
Hua rangi Aotearoa

Gracefield Research Centre
Gracefield Road
PO Box 30 547
Lower Hutt
New Zealand

AgriQuality Environmental
Phone: 64 4 570 6822
Fax: 64 4 569 4500

Email: <allwood@agriquality.co.nz>

Facsimile

AgriQuality NEW ZEALAND

To: Fiona Putt Fax: 06 765 5097

Company: Taranaki Regional Council Date: July 10, 2001

From: Jacinda Allwood Pages (including this page): 3

Re: TCDD Results for Marine Biota samples

Dear Fiona

Please find following the analytical certificate for the TCDD analysis of for your six Marine Biota samples received at AgriQuality Environmental on 11 May 2001. The results are reported in picograms per gram (pg/g), equivalent to ppt, on an as received basis to two significant figures.

The samples are also being analysed for organochlorine (OC) pesticides and polycyclic aromatic hydrocarbons (PAHs). The results for the OCs and the PAHs will be forwarded to you as soon as they become available.

If you have any queries or require any additional information please do not hesitate to contact us.

Kind regards

Jacinda Allwood
Team Leader
UltraTrace™ Laboratory
AgriQuality Environmental

Barry Van Inkarud
04 5708805

11.7.01
Fiona.
11 7 01
Kay

AgriQuality New Zealand Limited
Ihuarangi Aotearoa

Gracefield Road
P.O. Box 31 242
Lower Hutt, New Zealand

Phone: +64 4 570 8600
Facsimile: +64 4 569 4500

002

10 July 2001

Certificate of Analysis

Client: Taranaki Regional Council
Private Bag 713
Stratford
New Zealand

Attention: Fiona Putt

Date Received: 11 May 2001

Laboratory Reference: 01-1932

Sample Type: Marine Biota

Analysis: **2378 Tetrachlorodibenzo-*p*-dioxin (TCDD)**

Method: Based on USEPA Method 8290 (Isotope Dilution)

The samples were spiked with isotopically labelled surrogate standards and extracted with organic solvent. The extracts were purified by chemical treatment and solid phase chromatographic techniques. Measurement was performed using high resolution gas chromatography and high resolution electron impact mass spectrometry.

Results are reported in picograms per gram (pg/g), equivalent to ppt, on an as received basis to two significant figures. Results have been corrected for recoveries.

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

S V Leathem
UltraTrace™ Laboratory
AgriQuality Environmental

M L Mackey
UltraTrace™ Laboratory
AgriQuality Environmental

10 July 2001

Results

Laboratory Reference	Sample Identification	Sample Type	TCDD† pg/g	$^{13}C_{12}$ RE %	
01-1932/1	011011 - Kawaroa Reef	Marine Biota	0.15	84	CONTROL
01-1932/2	011012 - Old Elliot Street outfall	Marine Biota	0.34	101	
01-1932/3	011013 - Waireka 'cavern'	Marine Biota	0.094	112	
01-1932/4	011014 - Waireka 'control'	Marine Biota	0.096	112	CONTROL
01-1932/5	011033 - Paritutu Rock	Marine Biota	1.2	108	
01-1932/6	011034 - Belt Road	Marine Biota	0.13	112	

† = Results are reported on an as received basis.

Abbreviations:

CDD = chlorodibenzo-*p*-dioxin
T = tetra
$^{13}C_{12}$ RE = recovery of $^{13}C_{12}$ surrogate standard

pg/g = picograms per gram (equivalent to ppt)
ppt = parts per trillion

01-1932 todd

Appendix VII
Record of detailed site inspections

Memorandum

To Brian Calkin: Inspectorate Manager
From Bruce Pope: Investigating Officer
File F02/2 UIR400
Date 31 May 2001

Detailed inspection of alleged Dioxin dump sites

On Monday the 28 May 2001 and Wednesday the 30 of May 2001 detailed inspections of 22 alleged Dioxin dump sites was carried out by seven staff from the inspectorate section of the Taranaki Regional Council. The inspections involved walking all the sites on a shoulder to shoulder basis.

Site A – Lawry St Site

This site is situated on the corner of Devon Street West and Lawry Street and is adjacent to the Mangaotukutuku Stream. A full inspection from west to east parallel with Devon St West was undertaken, including a detailed inspection of the steep slope to the Mangaotukutuku Stream. Possible leachate points were found on the steep banks of the Mangaotukutuku Stream. The slope comprises unconsolidated soils covered in weedy vegetation.

Site B – Seaview Rd Site

This site is situated on the corner of Devon Street West and Seaview road and is adjacent to the Mangaotukutuku Stream. The site is bounded by a garage/service station and a car painting business to the south. A full inspection of the site and adjacent stream banks was undertaken. No evidence of contamination was found.

Sites C – Pylon 3 Site and V – Centennial-2 Site

The Pylon 3 site comprises an area of land between the IWD north-west boundary and Back Beach extending to Mt Moturoa, below a pylon outside the north-west corner boundary of the IWD plant, and extending to the beach. It is a relatively large area and includes a significant area of public reserve. There is a gully at the south-western end of the site that extends from the plant to the coast line. At the head of this gully there is a constructed stormwater pond located on, and for, the IWD site.

A beach walk was undertaken of Pylon 3, Centennial Drive and Centennial-2 sites and two leachate sites were found and marked with spray dye, they were:
- On back beach access track
- North of back beach access track

A full sweep of the Pylon 3 site between Centennial Drive and IWD fence from west to east was undertaken. Some plastic material was found on the surface north of Pylon 3 on the 4 wheel drive track, no other evidence of contamination was found.

Ca – Centennial Drive Site

This is a reserve area above the former stormwater discharge from the office block of IWD.

Inspection of site Ca showed that the area, a slight gully, has been planted in trees and is a reserve. Planting and tree release spraying has been undertaken in the last three months that would negate further investigation.

Site D – 34 Rangitake Drive Site

This is a residential property extending from Rangitake Drive to the Herekawe Stream. A pole house is located at the top of the section near the road. The remainder of the section is a grass terrace and steep vegetated bank down to the Herekawe Stream.

A full inspection was undertaken of the back of this section and there was no evidence of leachate and no foreign objects were found.

Site Da – 44 Rangitake Drive Site

This site is at the southern turnaround of Rangitake Drive and includes the house site. The house is adjacent to a vacant section, which is also included as part of this site, the street number for this section is 42 Rangitake Drive. The road frontage is tarsealed and concreted and a layer of lawn is on 44 Rangitake Drive. The bottom of the sections are relatively overgrown and is adjacent the Herekawe Stream. A full inspection of the area was undertaken and no evidence of dumping was found.

Site E – Omata Reserve Site

This site is directly on the western side of the Herekawe stream. East of the Methanex tank farm. The site is situated on New Plymouth District Council reserve land and has been planted with trees in previous years. A full inspection of the western (true left) bank was undertaken, the area is covered with thick undergrowth and no leachate or unusual problems were found.

Inspections were also done across the remainder of the property on the western side of the site, nothing obvious was found in this area.

A further full sweep of the eastern side (true right) of the Herekawe stream was also undertaken this showed a substantial lump of concrete 20m downstream from the sewerage pipe or start point, this was situated at the back of No 34 Rangitake Drive.
Also found on right hand bank:

- Novaflow at top near mesh on empty back section adjacent to 26A Rangitake Drive.
- Large cutting behind 26A Rangitake Drive on downstream side of house, midway between the cabbage trees and house
- 20metres downstream of 26A Rangitake Drive section boundary, ground water flow less than 1metre up from stream level

As part of the inspection weed eaters were used to cut away substantial excess woody growth. This also enabled access for GPR activities.

Site G – Marfell Park Site

The Marfell Park site is a former municipal landfill. The allegation received by the Council was that herbicide contaminated waste were disposed in an area near the 'top' (south-eastern) end of the former landfill site. According to the New Plymouth District Council, leachate from the former landfill is intercepted and discharged via a pipe to the Mangaotukutuku Stream. The discharge point is approximately 600m north-west of the alleged disposal site.

There is iron oxide staining present at the leachate discharge pipe and in the accumulated sediment immediately below the pipe.

The former landfill site has been developed as sports playing fields. Down gradient of the landfill site is a BMX track and a children's play area.

Two inspections of the site were undertaken, the first sweep from the eastern side of the park from the Cook Street end through the BMX track to Grenville Street. The second sweep from Grenville Street to Cook Street on the western side of the park. Several wet areas were found on the park during these sweeps. However, no other signs of leachate or surface contamination were discovered. Possible sampling sites could be from stormwater pipes in manholes on site or at the discharge point to the Mangaotukutuku Stream.

Further inspection of the known leachate discharge point from the old dump to the Mangatuku Stream was also undertaken, this site is off Endeavour street. A full inspection of the area was undertaken no signs or odours found.

Site H – Ngamotu Domain Site

The Ngamotu Domain site is a former municipal landfill. The site has been grassed and is now used as playing fields. The landfill site is on the western side of a gully formed by the Mangahererangi Stream. Several full inspections of the eastern side of the park, from south to north, showed signs of some odours which appeared to be leachate odour from the old dump site. The remainder of the site was inspected methodically with no other signs of leachate being found. Possible sampling sites were found on the eastern side of the park.

Site I – 7A Squire Place Site

The Squire place site is in a gully immediately beside the Ngamotu Domain. This site contains a stormwater pipe that allegedly contained leachate, which was discharged from the Ngamotu Domain landfill. A full inspection of the western side of the Squire Place was undertaken, this area is between the Ngamotu dump site and the Mangahererangi Stream which flows to Ngamotu beach. This stream would take leachate from the old dump site. Although no odours or strange materials were found during this inspection it was noted that some debris and discoloured water was evident on the opposite stream bank (true right). Samples recommended to be taken at the end of the discharge pipe and at the bottom boundary of the property.

Site J – Belt Road Site

This site is situated at the end of Belt road, over the railway line and on the coast. The area is grassed and is regularly mowed. It is immediately on the cliff face sloping to the foreshore of the Tasman Sea. Inspection did not indicate any leachate discharge points.

Site K – Victoria Road, Oakura Site

This site is on the first farm on the right up Victoria Road off State Highway 45 at Oakura. No leachate discharges were found.

Site M – Beach Road-1 Site

The Beach Road site is located at the base of a gully and incised into a flat terrace area. There is a wetland area at the base of the gully and adjacent to the alleged disposal site. A full inspection from the sea fence to Centennial Drive was undertaken, including an inspection of the wetlands area. No evidence of any discharges or dumping was found.

Site P – 26A Rangitake Drive Site

This site is at the rear of a residential property and backs on to the Herekawe Stream. The rear of the section comprises two grass terraces before steeply sloping to the Herekawe Stream. The steep bank is predominantly covered in kikuyu grass. A full inspection was undertaken along the back of 26A Rangitake Drive. This showed the following:

- Wet area at the lowest level down from the house
- 6 metres further east a wet area with an iron oxide sheen
- A rusted, crushed drum was located at stream level below the site, adjacent to the end of boundary fence. There was no evidence that this drum had contained agrichemicals. The drum has been removed.
- Leachate evident

Site Q – Rifle Range Rd/Bewley Rd

This site is located on Rifle Range road next to the true right bank of the Waiwhakaiho River and was used as a landfill site. It is now an industrial area.

A full inspection from west to east of the true right bank of the Waiwhakaiho River from the waters edge to Bewley Road was undertaken. Start point was GPS2605942E-6238969N. The following was found:

- Between start point and smart Road, various drums, a stormwater discharge pipe and some leachate.
- Between Smart road and Struthers Place, three stormwater pipes, small amount of rubbish and one leachate point.
- Between Struthers Place and Vickers Road, one 30 metre long leachate discharge, stormwater pipe and various pieces of metal.
  Between Vickers Road and the finish point, GPS2606845E-6239729N, Mangaone Stream, six stormwater discharge pipes.

Site R – Beach Road-2 Site

A flat paddock situated on the old IWD farm. No surface water discharge points are possible and there is no sign of any substance relating to drums.

Site X – Roto Street Site

This site consists of a gully adjacent to a recent housing subdivision, however no houses have been built at this stage. Fill material had been previously disposed of in the gully, particularly on the true left side near the head of the gully. Some concrete and asphalt rubble is present at the surface over part of the site. A small stream has been re-directed across and down the true left side of the gully. At the base of an exposed bank adjacent to the stream a seepage zone exists with numerous seeps. There is significant iron oxide staining around these seeps and in the streambed in the immediate vicinity.

A full inspection from the recent housing subdivision to the bush area was undertaken. It was noted that the drain that runs parallel to the site was discoloured with iron oxide.

Site Z – Ngahoro Site

The Ngahoro site is a known IWD disposal area where drums containing herbicide manufacturing wastes had previously been disposed. The drums, contents, and surrounding soil were removed for disposal at the Waireka landfill facility, and site clean-up undertaken, between 1981 and 1985.

The Ngahoro site is located on the seaward side of Centennial Drive approximately 2 km west of the IWD plant and 200 m east of the Beach Road-1 site (Site M). The site is located on the edge of an eroded terrace with steep gullies on the coastal side and flat terrace extending inland. At the base of the gullies, swampy/wetland areas feed small streams flowing towards the coast. There is likely to be a groundwater divide at the site with most groundwater flowing towards the northern gully and a lessor amount flowing to the southern gully.

A full inspection from Centennial Drive to a fence by sea was undertaken. A wet gully to the north of the site was also inspected. No visible signs of pollution were found.

Site Ze – Tank 3500

This is a flat area of farm land on the old Ivon Watkins Dow dairy farm. A full sweep from Centennial Drive fence line, past the Tank 3500 to a wetland/lake, then through wetlands area between lake and Centennial drive. There was no evidence of contamination in the wetland/lake and the surrounding area.

Site Zh – Car Park Site

This site is near the car park west of the Herekawe Stream on a walking track to the beach. No allegations of the presence of herbicide manufacturing residues have been made at this site. The reason this site was investigated and samples collected is to provide assurance to the public that the discharge is natural.

A full inspection showed no signs of any dumped material, however, at the beach end of the track there is a seepage zone with significant iron oxide staining and in the past the Council has received a number of enquiries regarding the rust coloured staining at the seepage zone.

Site Zi – Herekawe Cliff Site (Pylon 4)

The Pylon 4 site comprises the area below a pylon on the west boundary of the IWD property, extending to the beach. A gully extends from Pylon 4 and the south-western corner of the IWD site to the coast. A small stream flows down this gully and over the coastal cliff.

A beach walk was undertaken. Two leachate sites were found and marked with spray dye, they were:

- Near water fall and Hurricanes sign on cliff face
- North of the water fall area

Site Zk – Jury Site

This site is at the end of Norwich Avenue on the former Jury farm. Inspection showed some signs of broken concrete. No potential leachate discharge points were possible.

The following sites were not the subject of the detailed inspections reported above, for various reasons:

F – IWD-1 Site – on site at IWD and investigated later .

L – 23C Tahurangi Place Site – residential section, investigated later.

N – Waireka site – this is the subject of regular monitoring.

O – Pioneer Road Site– entrance way to Ngamotu Domain only.

T – Colson Road Landfill – subject of regular monitoring.

U – IWD-2 Site - on site at IWD and investigated later.

W – Herekawe Stream – current stormwater discharge subject to regular monitoring.

Za – 60 Marama Crescent - residential section, investigated later.

Zb - Buller Street Site – original IWD site. Investigated previously, sealed and covered with concrete.

Zc – Tarahua Road Site– Investigated previously, sealed and metalled.

Zd – Tasman Sea (Elliot St Outfall) – marine sites.

Zf – IWD-3 Site - on site at IWD and investigated later.

Zg – IWD-4 Site - on site at IWD and investigated later.

B E Pope
Investigating Officer

Appendix VIII
Record of site excavations

Memorandum

To Brian Calkin: Inspectorate Manager
From Bruce Pope: Investigating Officer
File FO2/2 UIR400
Date 15 August 2001

Further investigation into 2 sites- Alleged Historical Dioxin Disposal- Stage Two

1. On Tuesday the 14 August 2001 further investigation of two suspected dump sites was undertaken.

2. The purpose of this excavation was to ascertain what was the cause of diffractions detected on sites C, Pylon 3 and Ze, Tank 3500 in the report on Ground Penetrating Radar investigations undertaken by GPR Geotechnical Services.

3. The following are the results of the exploratory digging.

4. The works involved using a back-hoe type digger to excavate several exploratory holes.

5. **Site C, Pylon 3** - One exploratory hole was excavated at GPS 2598459E-6237492N in the western corner of this site. The hole was approximately 1m wide x 4m long x 3m deep. The soils excavated consisted of 300mm of sandy clay top soil, 1 metre of soft sand, 300mm of hard impermeable iron pan followed by insitu sand that was reasonably soft, permeable and easy to excavate.
   No sign of any foreign objects, which would cause the unusual radar readings, were found during this work.

   Conclusion – The unusual readings found by GPR at this site were due to hard iron pan and were apparently natural

6. **Site Ze, Tank 3500** - Three exploratory holes were excavated on this site. They were as follows:

   Hole 1
   This hole was excavated at GPS 2597893E-6235964N approximately 100 metres back from the Centennial Drive and 5 metres from the fence next to the Methanex tank farm (Omata 1). The hole was 1.5 metres wide x 4.0 long and 3.0 metres deep.

   The soils excavated consisted of 100mm of sandy clay top soil, 1 metre of hard clay, followed by sand which was reasonably soft, permeable and easy to excavate. At the bottom of the hole at 3 metres deep a bed of old native logs were found.

   Hole 2
   This hole was excavated at GPS 2597898E-6235945N 10 metres south west of the first hole and showed the same results as hole 1.

The soils excavated consisted of 100mm of sandy clay top soil, 1 metre of hard clay, followed by sand which was reasonably soft, permeable and easy to excavate. At the bottom of the hole at 3 metres deep a bed of old native logs were found.

Hole 3.
This hole was excavated at GPS 2597881E-6235976N 30 metres north of the original exploratory hole and although the consistency of the soil was different to the first two holes the results of the investigation was the same as the previous two dug.

7. **Conclusion**
This site showed that the irregular readings were due to a significant quantity of old logs being buried, probably in a pit or depression, then covered some years ago.

8. Both sites were reinstated at the conclusion of the works.

B E Pope
Investigating Officer

Appendix IX
Analytical results

AgriQuality New Zealand Limited
Hearangi Aotearoa

Gracefield Road
P.O. Box 31 242
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Phone: +64 4 570 8800
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12 July 2001

Certificate of Analysis

Client:	Taranaki Regional Council Private Bag 713 Stratford
Attention:	Gary Bedford
Date Received:	22 June 2001
Client Reference:	4044, 4046, 4047, 4050, 4051, 4052
AgriQuality Lab. Reference:	01-2575/1,3,4,7,8,9
Sample Type:	Sediment
Analysis:	**Organochlorine Pesticides**

Method:

The samples were extracted with organic solvent and the extracts analysed by gas chromatography - mass spectrometry. Detection limits are given for target compounds used to validate the analysis. Full details of the methodology are available on request.

Results are reported in milligrams per kilogram (ppm).

Analytical results are calculated on a dry weight basis.

K. J. Lange
Trace Organics Laboratory
AgriQuality Environmental

M. D. Valentine
Trace Organics Laboratory
AgriQuality Environmental

12 July 2001

SAMPLE DETAILS	
Client Reference	4044, 26A Lawn seeps
AgriQuality Lab. Reference	01-2575/1
Date Sampled	21/06/01
Date Extracted	03/07/01
USEPA Recommended Holding Time	14 days

RESULTS	
Organochlorine pesticides	**Level (mg/kg)**
hexachlorobenzene	< 0.1
alpha-BHC	< 0.1
beta-BHC	< 0.2
delta-BHC	< 0.2
lindane	< 0.2
aldrin	< 0.1
heptachlor	< 0.2
heptachlor epoxide	< 0.1
procymidone	< 0.2
alpha-chlordane	< 0.1
gamma-chlordane	< 0.1
endosulfan I	< 0.1
pp-DDE	< 0.1
dieldrin	< 0.1
pp-DDD	< 0.1
pp-DDT	< 0.3
endrin	< 0.2
endosulfan II	< 0.1
endrin aldehyde	< 0.1
endosulfan sulphate	< 0.1
endrin ketone	< 0.2
methoxychlor	< 0.3
cis permethrin	< 0.2
trans permethrin	< 0.2

< = Less than limit of detection

12 July 2001

SAMPLE DETAILS	
Client Reference	4046, Herekawe Street D/S of 26A
AgriQuality Lab. Reference	01-2575/3
Date Sampled	21/06/01
Date Extracted	03/07/01
USEPA Recommended Holding Time	14 days

RESULTS	
Organochlorine pesticides	Level (mg/kg)
hexachlorobenzene	< 0.1
alpha-BHC	< 0.1
beta-BHC	< 0.2
delta-BHC	< 0.2
lindane	< 0.2
aldrin	< 0.1
heptachlor	< 0.2
heptachlor epoxide	< 0.1
procymidone	< 0.2
alpha-chlordane	< 0.1
gamma-chlordane	< 0.1
endosulfan I	< 0.1
pp-DDE	< 0.1
dieldrin	< 0.1
pp-DDD	< 0.1
pp-DDT	< 0.3
endrin	< 0.2
endosulfan II	< 0.1
endrin aldehyde	< 0.1
endosulfan sulphate	< 0.1
endrin ketone	< 0.2
methoxychlor	< 0.3
cis permethrin	< 0.2
trans permethrin	< 0.2

< = Less than limit of detection

12 July 2001

SAMPLE DETAILS	
Client Reference	4047, Seep D/S 26A
AgriQuality Lab. Reference	01-2575/4
Date Sampled	21/06/01
Date Extracted	03/07/01
USEPA Recommended Holding Time	14 days

RESULTS	
Organochlorine pesticides	Level (mg/kg)
hexachlorobenzene	< 0.1
alpha-BHC	< 0.1
beta-BHC	< 0.2
delta-BHC	< 0.2
lindane	< 0.2
aldrin	< 0.1
heptachlor	< 0.2
heptachlor epoxide	< 0.1
procymidone	< 0.2
alpha-chlordane	< 0.1
gamma-chlordane	< 0.1
endosulfan I	< 0.1
pp-DDE	< 0.1
dieldrin	< 0.1
pp-DDD	< 0.1
pp-DDT	< 0.3
endrin	< 0.2
endosulfan II	< 0.1
endrin aldehyde	< 0.1
endosulfan sulphate	< 0.1
endrin ketone	< 0.2
methoxychlor	< 0.3
cis permethrin	< 0.2
trans permethrin	< 0.2

< = Less than limit of detection

12 July 2001

SAMPLE DETAILS	
Client Reference	4050, 32 Seeps/Damp area
AgriQuality Lab. Reference	01-2575/7
Date Sampled	21/06/01
Date Extracted	03/07/01
USEPA Recommended Holding Time	14 days

RESULTS	
Organochlorine pesticides	**Level (mg/kg)**
hexachlorobenzene	< 0.1
alpha-BHC	< 0.1
beta-BHC	< 0.2
delta-BHC	< 0.2
lindane	< 0.2
aldrin	< 0.1
heptachlor	< 0.2
heptachlor epoxide	< 0.1
procymidone	< 0.2
alpha-chlordane	< 0.1
gamma-chlordane	< 0.1
endosulfan I	< 0.1
pp-DDE	< 0.1
dieldrin	< 0.1
pp-DDD	< 0.1
pp-DDT	< 0.3
endrin	< 0.2
endosulfan II	< 0.1
endrin aldehyde	< 0.1
endosulfan sulphate	< 0.1
endrin ketone	< 0.2
methoxychlor	< 0.3
cis permethrin	< 0.2
trans permethrin	< 0.2

< = Less than limit of detection

12 July 2001

SAMPLE DETAILS	
Client Reference	4051, 34 Damp point near bank
AgriQuality Lab. Reference	01-2575/8
Date Sampled	21/06/01
Date Extracted	03/07/01
USEPA Recommended Holding Time	14 days

RESULTS	
Organochlorine pesticides	Level (mg/kg)
hexachlorobenzene	< 0.1
alpha-BHC	< 0.2
beta-BHC	< 0.3
delta-BHC	< 0.2
lindane	< 0.3
aldrin	< 0.1
heptachlor	< 0.3
heptachlor epoxide	< 0.1
procymidone	< 0.2
alpha-chlordane	< 0.1
gamma-chlordane	< 0.1
endosulfan I	< 0.1
pp-DDE	< 0.1
dieldrin	< 0.1
pp-DDD	< 0.1
pp-DDT	< 1
endrin	< 0.3
endosulfan II	< 0.1
endrin aldehyde	< 0.1
endosulfan sulphate	< 0.1
endrin ketone	< 0.5
methoxychlor	< 0.4
cis permethrin	< 0.2
trans permethrin	< 0.2

< = Less than limit of detection

12 July 2001

SAMPLE DETAILS	
Client Reference	4052, Herekawe Street D/S of SW outfall
AgriQuality Lab. Reference	01-2575/9
Date Sampled	21/06/01
Date Extracted	03/07/01
USEPA Recommended Holding Time	14 days

RESULTS	
Organochlorine pesticides	**Level (mg/kg)**
hexachlorobenzene	< 0.1
alpha-BHC	< 0.2
beta-BHC	< 0.3
delta-BHC	< 0.2
lindane	< 0.3
aldrin	< 0.1
heptachlor	< 0.3
heptachlor epoxide	< 0.1
procymidone	< 0.2
alpha-chlordane	< 0.1
gamma-chlordane	< 0.1
endosulfan I	< 0.1
pp-DDE	< 0.1
dieldrin	< 0.1
pp-DDD	< 0.1
pp-DDT	< 1
endrin	< 0.3
endosulfan II	< 0.1
endrin aldehyde	< 0.1
endosulfan sulphate	< 0.1
endrin ketone	< 0.5
methoxychlor	< 0.4
cis permethrin	< 0.2
trans permethrin	< 0.2

< = Less than limit of detection

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18 July 2001

Certificate of Analysis

Client: Taranaki Regional Council
Private Bag 713
Stratford

Attention: Gary Bedford

Date Received: 22 June 2001

Client Reference: 4044, 4046, 4047, 4050, 4051, 4052

AgriQuality Lab. Reference: 01-2575/1,3,4,7,8,9

Sample Type: Sediment

Analysis: **Acid Herbicide**

Method:

The samples were isolated by solid phase extraction and the extracts derivatised with diazomethane. Measurement was performed using gas chromatography - mass spectrometry. Full details of the methodology are available on request.

Results are reported in milligrams per kilogram (ppm).

Analytical results are calculated on a dry weight basis.

K. J. Lange
Trace Organics Laboratory
AgriQuality Environmental

M. D. Valentine
Trace Organics Laboratory
AgriQuality Environmental

18 July 2001

SAMPLE DETAILS	
Client Reference	4044, 26A Lawn seeps
AgriQuality Lab. Reference	01-2575/1
Date Sampled	21/06/01
Date Extracted	03/07/01
USEPA Recommended Holding Time	14 days

RESULTS	
Acid Herbicide	**Level (mg/kg)**
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 mg/kg

18 July 2001

SAMPLE DETAILS	
Client Reference	4046, Herekawe Street D/S of 26A
AgriQuality Lab. Reference	01-2575/3
Date Sampled	21/06/01
Date Extracted	03/07/01
USEPA Recommended Holding Time	14 days

RESULTS	
Acid Herbicide	Level (mg/kg)
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 mg/kg

18 July 2001

SAMPLE DETAILS	
Client Reference	4047, Seep D/S 26A
AgriQuality Lab. Reference	01-2575/4
Date Sampled	21/06/01
Date Extracted	03/07/01
USEPA Recommended Holding Time	14 days

RESULTS	
Acid Herbicide	**Level (mg/kg)**
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 mg/kg

18 July 2001

SAMPLE DETAILS	
Client Reference	4050, 32 Seeps/Damp area
AgriQuality Lab. Reference	01-2575/7
Date Sampled	21/06/01
Date Extracted	03/07/01
USEPA Recommended Holding Time	14 days

RESULTS	
Acid Herbicide	**Level (mg/kg)**
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 mg/kg

18 July 2001

SAMPLE DETAILS	
Client Reference	4051, 34 Damp point near bank
AgriQuality Lab. Reference	01-2575/8
Date Sampled	21/06/01
Date Extracted	03/07/01
USEPA Recommended Holding Time	14 days

RESULTS	
Acid Herbicide	**Level (mg/kg)**
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 mg/kg

18 July 2001

SAMPLE DETAILS	
Client Reference	4052, Herekawe Street D/S of SW outfall
AgriQuality Lab. Reference	01-2575/9
Date Sampled	21/06/01
Date Extracted	03/07/01
USEPA Recommended Holding Time	14 days

RESULTS	
Acid Herbicide	**Level (mg/kg)**
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 mg/kg

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06 July 2001

Certificate of Analysis

Client:	Taranaki Regional Council Private Bag 713 Stratford
Attention:	Gary Bedford
Date Received:	27 June 2001
Client Reference:	4053 A, 4054 A, 4056 A, 4057 A
AgriQuality Lab. Reference:	01-2634/1,2,4,5
Sample Type:	Sediment
Analysis:	**Acid Herbicide**

Method:

The samples were isolated by solid phase extraction and the extracts derivatised with diazomethane. Measurement was performed using gas chromatography - mass spectrometry. Full details of the methodology are available on request.

Results are reported in milligrams per kilogram (ppm).

Analytical results are calculated on a dry weight basis.

K. J. Lange
Trace Organics Laboratory
AgriQuality Environmental

M. D. Valentine
Trace Organics Laboratory
AgriQuality Environmental

06 July 2001

SAMPLE DETAILS	
Client Reference	4053 A, 23C Tahurangi Pl along fence
AgriQuality Lab. Reference	01-2634/1
Date Sampled	26/06/01
Date Extracted	02/07/01
USEPA Recommended Holding Time	14 days

RESULTS	
Acid Herbicide	**Level (mg/kg)**
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 mg/kg

06 July 2001

SAMPLE DETAILS	
Client Reference	4054 A, 23C Tahurangi Pl under house
AgriQuality Lab. Reference	01-2634/2
Date Sampled	26/06/01
Date Extracted	02/07/01
USEPA Recommended Holding Time	14 days

RESULTS	
Acid Herbicide	**Level (mg/kg)**
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 mg/kg

06 July 2001

SAMPLE DETAILS	
Client Reference	4056 A, Beach access track west of Herekawe Stream
AgriQuality Lab. Reference	01-2634/4
Date Sampled	26/06/01
Date Extracted	02/07/01
USEPA Recommended Holding Time	14 days

RESULTS	
Acid Herbicide	**Level (mg/kg)**
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 mg/kg

06 July 2001

SAMPLE DETAILS	
Client Reference	4057 A, Corner Granville and Endeavour Streets
AgriQuality Lab. Reference	01-2634/5
Date Sampled	26/06/01
Date Extracted	02/07/01
USEPA Recommended Holding Time	14 days

RESULTS	
Acid Herbicide	**Level (mg/kg)**
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 mg/kg

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06 July 2001

Certificate of Analysis

Client:	Taranaki Regional Council Private Bag 713 Stratford
Attention:	Gary Bedford
Date Received:	27 June 2001
Client Reference:	4055 A
AgriQuality Lab. Reference:	01-2634/3
Sample Type:	Aqueous
Analysis:	**Acid Herbicide**

Method:

The sample was isolated by solid phase extraction and the extract derivatised with diazomethane. Measurement was performed using gas chromatography - mass spectrometry. Full details of the methodology and precision are available on request.

Results are reported in micrograms per litre (ppb).

Analytical results are for samples as received.

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

K. J. Lange
Trace Organics Laboratory
AgriQuality Environmental

M. D. Valentine
Trace Organics Laboratory
AgriQuality Environmental

06 July 2001

SAMPLE DETAILS	
Client Reference	4055 A, Dow stormwater outlet, Herekawe Stream mouth
AgriQuality Lab. Reference	01-2634/3
Date Sampled	26/06/01
Date Extracted	02/07/01
USEPA Recommended Holding Time	7 days

RESULTS	
Acid Herbicide	**Level (µg/L)**
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 µg/L

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12 July 2001

Certificate of Analysis

Client:	Taranaki Regional Council Private Bag 713 Stratford
Attention:	Gary Bedford
Date Received:	27 June 2001
Client Reference:	4056 A, 4057 A
AgriQuality Lab. Reference:	01-2634/4,5
Sample Type:	Sediment
Analysis:	**Organochlorine Pesticides**

Method:

The samples were extracted with organic solvent and the extracts analysed by gas chromatography - mass spectrometry. Detection limits are given for target compounds used to validate the analysis. Full details of the methodology are available on request.

Results are reported in milligrams per kilogram (ppm).

Analytical results are calculated on a dry weight basis.

K. J. Lange
Trace Organics Laboratory
AgriQuality Environmental

M. D. Valentine
Trace Organics Laboratory
AgriQuality Environmental

12 July 2001

SAMPLE DETAILS	
Client Reference	4056 A, Beach access track west of Herekawe Stream
AgriQuality Lab. Reference	01-2634/4
Date Sampled	26/06/01
Date Extracted	03/07/01
USEPA Recommended Holding Time	14 days

RESULTS	
Organochlorine pesticides	**Level (mg/kg)**
hexachlorobenzene	< 0.1
alpha-BHC	< 0.1
beta-BHC	< 0.2
delta-BHC	< 0.2
lindane	< 0.2
aldrin	< 0.1
heptachlor	< 0.2
heptachlor epoxide	< 0.1
procymidone	< 0.2
alpha-chlordane	< 0.1
gamma-chlordane	< 0.1
endosulfan I	< 0.1
pp-DDE	< 0.1
dieldrin	< 0.1
pp-DDD	< 0.1
pp-DDT	< 0.3
endrin	< 0.2
endosulfan II	< 0.1
endrin aldehyde	< 0.1
endosulfan sulphate	< 0.1
endrin ketone	< 0.2
methoxychlor	< 0.3
cis permethrin	< 0.2
trans permethrin	< 0.2

< = Less than limit of detection

12 July 2001

SAMPLE DETAILS	
Client Reference	4057 A, Corner Granville and Endeavour Streets
AgriQuality Lab. Reference	01-2634/5
Date Sampled	26/06/01
Date Extracted	03/07/01
USEPA Recommended Holding Time	14 days

RESULTS	
Organochlorine pesticides	Level (mg/kg)
hexachlorobenzene	< 0.1
alpha-BHC	< 0.1
beta-BHC	< 0.2
delta-BHC	< 0.2
lindane	< 0.2
aldrin	< 0.1
heptachlor	< 0.2
heptachlor epoxide	< 0.1
procymidone	< 0.2
alpha-chlordane	< 0.1
gamma-chlordane	< 0.1
endosulfan I	< 0.1
pp-DDE	< 0.1
dieldrin	< 0.1
pp-DDD	< 0.1
pp-DDT	< 0.3
endrin	< 0.2
endosulfan II	< 0.1
endrin aldehyde	< 0.1
endosulfan sulphate	< 0.1
endrin ketone	< 0.2
methoxychlor	< 0.3
cis permethrin	< 0.2
trans permethrin	< 0.2

< = Less than limit of detection

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03 July 2001

Certificate of Analysis

Client:	Taranaki Regional Council Private Bag 713 Stratford
Attention:	Gary Bedford
Date Received:	12 June 2001
Client Reference:	4022 A
AgriQuality Lab. Reference:	01-2422/1
Sample Type:	Aqueous
Analysis:	**Acid Herbicide**

Method:

The sample was isolated by solid phase extraction and the extract derivatised with diazomethane. Measurement was performed using gas chromatography - mass spectrometry. Full details of the methodology and precision are available on request.

Results are reported in micrograms per litre (ppb).

Analytical results are for samples as received.

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

J. Fry
Trace Organics Laboratory
AgriQuality Environmental

M. D. Valentine
Trace Organics Laboratory
AgriQuality Environmental

03 July 2001

SAMPLE DETAILS	
Client Reference	4022 A, D/S Ngamotu Domain
AgriQuality Lab. Reference	01-2422/1
Date Sampled	11/06/01
Date Extracted	18/06/01
USEPA Recommended Holding Time	7 days

RESULTS	
Acid Herbicide	**Level (µg/L)**
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 µg/L

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04 July 2001

Certificate of Analysis

Client:	Taranaki Regional Council Private Bag 713 Stratford
Attention:	Gary Bedford
Date Received:	12 June 2001
Client Reference:	4022 A
AgriQuality Lab. Reference:	01-2422/1
Sample Type:	Aqueous
Analysis:	**Organochlorine Pesticides**

Method:

The sample was extracted with organic solvent and the extract analysed by gas chromatography - mass spectrometry. Detection limits are given for target compounds used to validate the analysis. Full details of the methodology and precision are available on request.

Results are reported in micrograms per litre (ppb).

Analytical results are for samples as received.

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

J. Fry
Trace Organics Laboratory
AgriQuality Environmental

M. D. Valentine
Trace Organics Laboratory
AgriQuality Environmental

04 July 2001

SAMPLE DETAILS	
Client Reference	4022 A, D/S Ngamotu Domain
AgriQuality Lab. Reference	01-2422/1
Date Sampled	11/06/01
Date Extracted	18/06/01
USEPA Recommended Holding Time	7 days

RESULTS	
Organochlorine pesticides	Level (µg/L)
hexachlorobenzene	< 0.1
alpha-BHC	< 0.1
beta-BHC	< 0.1
delta-BHC	< 0.1
lindane	< 0.01
aldrin	< 0.01
heptachlor	< 0.01
heptachlor epoxide	< 0.01
procymidone	< 0.2
alpha-chlordane	< 0.01
gamma-chlordane	< 0.1
endosulfan I	< 0.1
pp-DDE	< 0.1
dieldrin	< 0.01
pp-DDD	< 0.1
pp-DDT	< 0.2
endrin	< 0.1
endosulfan II	< 0.1
endrin aldehyde	< 0.1
endosulfan sulphate	< 0.1
endrin ketone	< 0.1
methoxychlor	< 0.2
cis permethrin	< 0.2
trans permethrin	< 0.2

< = Less than limit of detection

AgriQuality New Zealand Limited
Hu:rangi Aotearoa

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28 June 2001

Certificate of Analysis

AgriQuality NEW ZEALAND

Client:	Taranaki Regional Council Private Bag 713 Stratford
Attention:	Gary Bedford
Date Received:	7 June 2001
Client Reference:	4000 A
AgriQuality Lab. Reference:	01-2338/2
Sample Type:	Aqueous
Analysis:	**Organochlorine Pesticides**

Method:

The samples were extracted with organic solvent and the extracts analysed by gas chromatography - mass spectrometry. Detection limits are given for target compounds used to validate the analysis. Full details of the methodology and precision are available on request.

Results are reported in micrograms per litre (ppb).

Analytical results are for samples as received.

laboratory

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

J. Fry
Trace Organics Laboratory
AgriQuality Environmental

M. D. Valentine
Trace Organics Laboratory
AgriQuality Environmental

28 June 2001

SAMPLE DETAILS	
Client Reference	4000 A, Leachate from drain from Marfell Park
AgriQuality Lab. Reference	01-2338/2
Date Sampled	06/06/01
Date Extracted	11/06/01
USEPA Recommended Holding Time	7 days

RESULTS	
Organochlorine pesticides	Level (µg/L)
hexachlorobenzene	< 1
alpha-BHC	< 1
beta-BHC	< 1
delta-BHC	< 1
lindane	< 1
aldrin	< 1
heptachlor	< 1
heptachlor epoxide	< 1
procymidone	< 2
alpha-chlordane	< 1
gamma-chlordane	< 1
endosulfan I	< 1
pp-DDE	< 1
dieldrin	< 1
pp-DDD	< 1
pp-DDT	< 2
endrin	< 1
endosulfan II	< 1
endrin aldehyde	< 1
endosulfan sulphate	< 1
endrin ketone	< 1
methoxychlor	< 2
cis permethrin	< 2
trans permethrin	< 2

< = Less than limit of detection

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28 June 2001

Certificate of Analysis

Client:	Taranaki Regional Council Private Bag 713 Stratford
Attention:	Gary Bedford
Date Received:	7 June 2001
Client Reference:	4000 A
AgriQuality Lab. Reference:	01-2338/2
Sample Type:	Aqueous
Analysis:	**Acid Herbicide**

Method:

The sample was isolated by solid phase extraction and the extract derivatised with diazomethane. Measurement was performed using gas chromatography - mass spectrometry. Full details of the methodology and precision are available on request.

Results are reported in micrograms per litre (ppb).

Analytical results are for samples as received.

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

J. Fry
Trace Organics Laboratory
AgriQuality Environmental

M. D. Valentine
Trace Organics Laboratory
AgriQuality Environmental

28 June 2001

SAMPLE DETAILS	
Client Reference	4000 A, Leachate from drain from Marfell Park
AgriQuality Lab. Reference	01-2338/2
Date Sampled	06/06/01
Date Extracted	12/06/01
USEPA Recommended Holding Time	7 days

RESULTS	
Acid Herbicide	Level (µg/L)
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	3
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 1 µg/L.

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28 June 2001

Certificate of Analysis

AgriQuality NEW ZEALAND

Client:	Taranaki Regional Council Private Bag 713 Stratford
Attention:	Gary Bedford
Date Received:	8 June 2001
Client Reference:	4018 A
AgriQuality Lab. Reference:	01-2392/9
Sample Type:	Aqueous
Analysis:	**Organochlorine Pesticides**

Method:

The samples were extracted with organic solvent and the extracts analysed by gas chromatography - mass spectrometry. Detection limits are given for target compounds used to validate the analysis. Full details of the methodology and precision are available on request.

Results are reported in micrograms per litre (ppb).

Analytical results are for samples as received.

laboratory

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

J. Fry
Trace Organics Laboratory
AgriQuality Environmental

M. D. Valentine
Trace Organics Laboratory
AgriQuality Environmental

28 June 2001

SAMPLE DETAILS	
Client Reference	4018 A, Water Seep Roto Street
AgriQuality Lab. Reference	01-2392/9
Date Sampled	07/06/01
Date Extracted	11/06/01
USEPA Recommended Holding Time	7 days

RESULTS	
Organochlorine pesticides	Level (µg/L)
hexachlorobenzene	< 0.1
alpha-BHC	< 0.1
beta-BHC	< 0.1
delta-BHC	< 0.1
lindane	< 0.01
aldrin	< 0.01
heptachlor	< 0.01
heptachlor epoxide	< 0.01
procymidone	< 0.2
alpha-chlordane	< 0.01
gamma-chlordane	< 0.1
endosulfan I	< 0.1
pp-DDE	< 0.1
dieldrin	< 0.01
pp-DDD	< 0.1
pp-DDT	< 0.2
endrin	< 0.1
endosulfan II	< 0.1
endrin aldehyde	< 0.1
endosulfan sulphate	< 0.1
endrin ketone	< 0.1
methoxychlor	< 0.2
cis permethrin	< 0.2
trans permethrin	< 0.2

< = Less than limit of detection

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28 June 2001

Certificate of Analysis

AgriQuality NEW ZEALAND

Client:	Taranaki Regional Council Private Bag 713 Stratford
Attention:	Gary Bedford
Date Received:	8 June 2001
Client Reference:	4018 A
AgriQuality Lab. Reference:	01-2392/9
Sample Type:	Aqueous
Analysis:	**Acid Herbicide**

Method:

The sample was isolated by solid phase extraction and the extract derivatised with diazomethane. Measurement was performed using gas chromatography - mass spectrometry. Full details of the methodology and precision are available on request.

Results are reported in micrograms per litre (ppb).

Analytical results are for samples as received.

laboratory

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

J. Fry
Trace Organics Laboratory
AgriQuality Environmental

M. D. Valentine
Trace Organics Laboratory
AgriQuality Environmental

28 June 2001

SAMPLE DETAILS	
Client Reference	4018 A, Water Seep Roto Street
AgriQuality Lab. Reference	01-2392/9
Date Sampled	07/06/01
Date Extracted	12/06/01
USEPA Recommended Holding Time	7 days

RESULTS	
Acid Herbicide	Level (µg/L)
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 µg/L

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03 July 2001

Certificate of Analysis

Client:	Taranaki Regional Council Private Bag 713 Stratford
Attention:	Gary Bedford
Date Received:	13 June 2001
Client Reference:	4028 A, 4033 A
AgriQuality Lab. Reference:	01-2434/2,7
Sample Type:	Aqueous
Analysis:	**Acid Herbicide**

Method:

The sample was isolated by solid phase extraction and the extract derivatised with diazomethane. Measurement was performed using gas chromatography - mass spectrometry. Full details of the methodology and precision are available on request.

Results are reported in micrograms per litre (ppb).

Analytical results are for samples as received.

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

K. J. Lange
Trace Organics Laboratory
AgriQuality Environmental

M. D. Valentine
Trace Organics Laboratory
AgriQuality Environmental

03 July 2001

SAMPLE DETAILS	
Client Reference	4028 A, Pylon 4 above waterfall
AgriQuality Lab. Reference	01-2434/2
Date Sampled	12/06/01
Date Extracted	19/06/01
USEPA Recommended Holding Time	7 days

RESULTS	
Acid Herbicide	**Level (µg/L)**
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	0.2

ND The letters ND mean "not detected" above the detection limit of 0.1 µg/L

03 July 2001

SAMPLE DETAILS	
Client Reference	4033 A, Paritutu Gully old sump
AgriQuality Lab. Reference	01-2434/7
Date Sampled	12/06/01
Date Extracted	19/06/01
USEPA Recommended Holding Time	7 days

RESULTS	
Acid Herbicide	**Level (µg/L)**
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	0.4
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 µg/L

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04 July 2001

Certificate of Analysis

AgriQuality NEW ZEALAND

Client:	Taranaki Regional Council Private Bag 713 Stratford
Attention:	Gary Bedford
Date Received:	13 June 2001
Client Reference:	4031 A, 4032 A, 4034 A
AgriQuality Lab. Reference:	01-2434/5,6,8
Sample Type:	Sediment
Analysis:	**Organochlorine Pesticides**

Method:

The samples were extracted with organic solvent and the extracts analysed by gas chromatography - mass spectrometry. Detection limits are given for target compounds used to validate the analysis. Full details of the methodology are available on request.

Results are reported in milligrams per kilogram (ppm).

Analytical results are calculated on a dry weight basis.

K. J. Lange
Trace Organics Laboratory
AgriQuality Environmental

M. D. Valentine
Trace Organics Laboratory
AgriQuality Environmental

04 July 2001

SAMPLE DETAILS	
Client Reference	4031 A, Pylon 3 trackside sediment
AgriQuality Lab. Reference	01-2434/5
Date Sampled	12/06/01
Date Extracted	19/06/01
USEPA Recommended Holding Time	14 days

RESULTS	
Organochlorine pesticides	**Level (mg/kg)**
hexachlorobenzene	< 0.1
alpha-BHC	< 0.1
beta-BHC	< 0.1
delta-BHC	< 0.1
lindane	< 0.1
aldrin	< 0.1
heptachlor	< 0.1
heptachlor epoxide	< 0.1
procymidone	< 0.2
alpha-chlordane	< 0.1
gamma-chlordane	< 0.1
endosulfan I	< 0.1
pp-DDE	< 0.1
dieldrin	< 0.1
pp-DDD	< 0.1
pp-DDT	< 0.5
endrin	< 0.1
endosulfan II	< 0.1
endrin aldehyde	< 0.1
endosulfan sulphate	< 0.1
endrin ketone	< 0.1
methoxychlor	< 0.2
cis permethrin	< 0.2
trans permethrin	< 0.2

< = Less than limit of detection

04 July 2001

SAMPLE DETAILS	
Client Reference	4032 A, Pylon 3 sediment below seep
AgriQuality Lab. Reference	01-2434/6
Date Sampled	12/06/01
Date Extracted	19/06/01
USEPA Recommended Holding Time	14 days

RESULTS	
Organochlorine pesticides	**Level (mg/kg)**
hexachlorobenzene	< 0.1
alpha-BHC	< 0.1
beta-BHC	< 0.1
delta-BHC	< 0.1
lindane	< 0.1
aldrin	< 0.1
heptachlor	< 0.1
heptachlor epoxide	< 0.1
procymidone	< 0.2
alpha-chlordane	< 0.1
gamma-chlordane	< 0.1
endosulfan I	< 0.1
pp-DDE	< 0.1
dieldrin	< 0.1
pp-DDD	< 0.1
pp-DDT	< 0.5
endrin	< 0.1
endosulfan II	< 0.1
endrin aldehyde	< 0.1
endosulfan sulphate	< 0.1
endrin ketone	< 0.1
methoxychlor	< 0.2
cis permethrin	< 0.2
trans permethrin	< 0.2

< = Less than limit of detection

04 July 2001

SAMPLE DETAILS	
Client Reference	4034 A, Paritutu Gully sediment below seep
AgriQuality Lab. Reference	01-2434/8
Date Sampled	12/06/01
Date Extracted	19/06/01
USEPA Recommended Holding Time	14 days

RESULTS	
Organochlorine pesticides	**Level (mg/kg)**
hexachlorobenzene	< 0.1
alpha-BHC	< 0.1
beta-BHC	< 0.1
delta-BHC	< 0.1
lindane	< 0.1
aldrin	< 0.1
heptachlor	< 0.1
heptachlor epoxide	< 0.1
procymidone	< 0.2
alpha-chlordane	< 0.1
gamma-chlordane	< 0.1
endosulfan I	< 0.1
pp-DDE	< 0.1
dieldrin	< 0.1
pp-DDD	< 0.1
pp-DDT	< 0.5
endrin	< 0.1
endosulfan II	< 0.1
endrin aldehyde	< 0.1
endosulfan sulphate	< 0.1
endrin ketone	< 0.1
methoxychlor	< 0.2
cis permethrin	< 0.2
trans permethrin	< 0.2

< = Less than limit of detection

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04 July 2001

Certificate of Analysis

AgriQuality NEW ZEALAND

Client:	Taranaki Regional Council Private Bag 713 Stratford
Attention:	Gary Bedford
Date Received:	13 June 2001
Client Reference:	4028 A, 4033 A
AgriQuality Lab. Reference:	01-2434/2,7
Sample Type:	Aqueous
Analysis:	**Organochlorine Pesticides**

Method:

The samples were extracted with organic solvent and the extracts analysed by gas chromatography - mass spectrometry. Detection limits are given for target compounds used to validate the analysis. Full details of the methodology and precision are available on request.

Results are reported in micrograms per litre (ppb).

Analytical results are for samples as received.

laboratory

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

K. J. Lange
Trace Organics Laboratory
AgriQuality Environmental

M. D. Valentine
Trace Organics Laboratory
AgriQuality Environmental

04 July 2001

SAMPLE DETAILS	
Client Reference	4028 A, Pylon 4 above waterfall
AgriQuality Lab. Reference	01-2434/2
Date Sampled	12/06/01
Date Extracted	18/06/01
USEPA Recommended Holding Time	7 days

RESULTS	
Organochlorine pesticides	**Level (µg/L)**
hexachlorobenzene	< 0.1
alpha-BHC	< 0.1
beta-BHC	< 0.1
delta-BHC	< 0.1
lindane	< 0.01
aldrin	< 0.01
heptachlor	< 0.01
heptachlor epoxide	< 0.01
procymidone	< 0.2
alpha-chlordane	< 0.01
gamma-chlordane	< 0.1
endosulfan I	< 0.1
pp-DDE	< 0.1
dieldrin	< 0.01
pp-DDD	< 0.1
pp-DDT	< 0.2
endrin	< 0.1
endosulfan II	< 0.1
endrin aldehyde	< 0.1
endosulfan sulphate	< 0.1
endrin ketone	< 0.1
methoxychlor	< 0.2
cis permethrin	< 0.2
trans permethrin	< 0.2

< = Less than limit of detection

04 July 2001

SAMPLE DETAILS	
Client Reference	4033 A, Paritutu Gully old sump
AgriQuality Lab. Reference	01-2434/7
Date Sampled	12/06/01
Date Extracted	18/06/01
USEPA Recommended Holding Time	7 days

RESULTS	
Organochlorine pesticides	**Level (µg/L)**
hexachlorobenzene	< 0.1
alpha-BHC	< 0.1
beta-BHC	< 0.1
delta-BHC	< 0.1
lindane	< 0.01
aldrin	< 0.01
heptachlor	< 0.01
heptachlor epoxide	< 0.01
procymidone	< 0.2
alpha-chlordane	< 0.01
gamma-chlordane	< 0.1
endosulfan I	< 0.1
pp-DDE	< 0.1
dieldrin	< 0.01
pp-DDD	< 0.1
pp-DDT	< 0.2
endrin	< 0.1
endosulfan II	< 0.1
endrin aldehyde	< 0.1
endosulfan sulphate	< 0.1
endrin ketone	< 0.1
methoxychlor	< 0.2
cis permethrin	< 0.2
trans permethrin	< 0.2

< = Less than limit of detection

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03 July 2001

Certificate of Analysis

Client:	Taranaki Regional Council Private Bag 713 Stratford
Attention:	Gary Bedford
Date Received:	13 June 2001
Client Reference:	4031 A, 4032 A, 4034 A
AgriQuality Lab. Reference:	01-2434/5,6,8
Sample Type:	Sediment
Analysis:	**Acid Herbicide**

Method:

The sample was isolated by solid phase extraction and the extract derivatised with diazomethane. Measurement was performed using gas chromatography - mass spectrometry. Full details of the methodology are available on request.

Results are reported in milligrams per kilogram (ppm).

Analytical results are calculated on a dry weight basis.

K. J. Lange
Trace Organics Laboratory
AgriQuality Environmental

M. D. Valentine
Trace Organics Laboratory
AgriQuality Environmental

03 July 2001

SAMPLE DETAILS	
Client Reference	4031 A, Pylon 3 trackside sediment
AgriQuality Lab. Reference	01-2434/5
Date Sampled	12/06/01
Date Extracted	19/06/01
USEPA Recommended Holding Time	14 days

RESULTS	
Acid Herbicide	**Level (mg/kg)**
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 mg/kg

03 July 2001

SAMPLE DETAILS	
Client Reference	4032 A, Pylon 3 sediment below seep
AgriQuality Lab. Reference	01-2434/6
Date Sampled	12/06/01
Date Extracted	19/06/01
USEPA Recommended Holding Time	14 days

RESULTS	
Acid Herbicide	**Level (mg/kg)**
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 mg/kg

03 July 2001

SAMPLE DETAILS	
Client Reference	4034 A, Paritutu Gully sediment below seep
AgriQuality Lab. Reference	01-2434/8
Date Sampled	12/06/01
Date Extracted	19/06/01
USEPA Recommended Holding Time	14 days

RESULTS	
Acid Herbicide	**Level (mg/kg)**
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 mg/kg

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03 July 2001

Certificate of Analysis

Client:	Taranaki Regional Council Private Bag 713 Stratford
Attention:	Gary Bedford
Date Received:	14 June 2001
Client Reference:	4039 A, 4041 A, 4042 A
AgriQuality Lab. Reference:	01-2454/4,6,7
Sample Type:	Sediment
Analysis:	**Acid Herbicide**

Method:

The samples were isolated by solid phase extraction and the extracts derivatised with diazomethane. Measurement was performed using gas chromatography - mass spectrometry. Full details of the methodology are available on request.

Results are reported in milligrams per kilogram (ppm).

Analytical results are calculated on a dry weight basis.

K. J. Lange
Trace Organics Laboratory
AgriQuality Environmental

M. D. Valentine
Trace Organics Laboratory
AgriQuality Environmental

03 July 2001

SAMPLE DETAILS	
Client Reference	4039 A, Sediment at pipe discharge, 9m v/s pipe crossing
AgriQuality Lab. Reference	01-2454/4
Date Sampled	13/06/01
Date Extracted	19/06/01
USEPA Recommended Holding Time	14 days

RESULTS	
Acid Herbicide	**Level (mg/kg)**
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 mg/kg

03 July 2001

SAMPLE DETAILS	
Client Reference	4041 A, Sediment at stormwater pipe with flap, discharge point
AgriQuality Lab. Reference	01-2454/6
Date Sampled	13/06/01
Date Extracted	19/06/01
USEPA Recommended Holding Time	14 days

RESULTS	
Acid Herbicide	**Level (mg/kg)**
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 mg/kg

03 July 2001

SAMPLE DETAILS	
Client Reference	4042 A, Waiwhakaiho River v/s seep zone
AgriQuality Lab. Reference	01-2454/7
Date Sampled	13/06/01
Date Extracted	19/06/01
USEPA Recommended Holding Time	14 days

RESULTS	
Acid Herbicide	**Level (mg/kg)**
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 mg/kg

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05 July 2001

Certificate of Analysis

Client:	Taranaki Regional Council Private Bag 713 Stratford
Attention:	Gary Bedford
Date Received:	14 June 2001
Client Reference:	4039 A, 4041 A, 4042 A
AgriQuality Lab. Reference:	01-2454/4,6,7
Sample Type:	Sediment
Analysis:	**Organochlorine Pesticides**

Method:

The samples were extracted with organic solvent and the extracts analysed by gas chromatography - mass spectrometry. Detection limits are given for target compounds used to validate the analysis. Full details of the methodology are available on request.

Results are reported in milligrams per kilogram (ppm).

Analytical results are calculated on a dry weight basis.

K. J. Lange
Trace Organics Laboratory
AgriQuality Environmental

M. D. Valentine
Trace Organics Laboratory
AgriQuality Environmental

05 July 2001

SAMPLE DETAILS	
Client Reference	4039 A, Sediment at pipe discharge, 9m v/s pipe crossing
AgriQuality Lab. Reference	01-2454/4
Date Sampled	13/06/01
Date Extracted	19/06/01
USEPA Recommended Holding Time	14 days

RESULTS	
Organochlorine pesticides	**Level (mg/kg)**
hexachlorobenzene	< 0.1
alpha-BHC	< 0.1
beta-BHC	< 0.1
delta-BHC	< 0.1
lindane	< 0.1
aldrin	< 0.1
heptachlor	< 0.1
heptachlor epoxide	< 0.1
procymidone	< 0.2
alpha-chlordane	< 0.1
gamma-chlordane	< 0.1
endosulfan I	< 0.1
pp-DDE	< 0.1
dieldrin	< 0.1
pp-DDD	< 0.1
pp-DDT	< 0.5
endrin	< 0.1
endosulfan II	< 0.1
endrin aldehyde	< 0.1
endosulfan sulphate	< 0.1
endrin ketone	< 0.1
methoxychlor	< 0.2
cis permethrin	< 0.2
trans permethrin	< 0.2

< = Less than limit of detection

05 July 2001

SAMPLE DETAILS	
Client Reference	4041 A, Sediment at stormwater pipe with flap, discharge point
AgriQuality Lab. Reference	01-2454/6
Date Sampled	13/06/01
Date Extracted	19/06/01
USEPA Recommended Holding Time	14 days

RESULTS	
Organochlorine pesticides	**Level (mg/kg)**
hexachlorobenzene	< 0.1
alpha-BHC	< 0.1
beta-BHC	< 0.1
delta-BHC	< 0.1
lindane	< 0.1
aldrin	< 0.1
heptachlor	< 0.1
heptachlor epoxide	< 0.1
procymidone	< 0.2
alpha-chlordane	< 0.1
gamma-chlordane	< 0.1
endosulfan I	< 0.1
pp-DDE	< 0.1
dieldrin	< 0.1
pp-DDD	< 0.1
pp-DDT	< 0.5
endrin	< 0.1
endosulfan II	< 0.1
endrin aldehyde	< 0.1
endosulfan sulphate	< 0.1
endrin ketone	< 0.1
methoxychlor	< 0.2
cis permethrin	< 0.2
trans permethrin	< 0.2

< = Less than limit of detection

05 July 2001

SAMPLE DETAILS	
Client Reference	4042 A, Waiwhakaiho River v/s seep zone
AgriQuality Lab. Reference	01-2454/7
Date Sampled	13/06/01
Date Extracted	19/06/01
USEPA Recommended Holding Time	14 days

RESULTS	
Organochlorine pesticides	**Level (mg/kg)**
hexachlorobenzene	< 0.1
alpha-BHC	< 0.1
beta-BHC	< 0.1
delta-BHC	< 0.1
lindane	< 0.1
aldrin	< 0.1
heptachlor	< 0.1
heptachlor epoxide	< 0.1
procymidone	< 0.2
alpha-chlordane	< 0.1
gamma-chlordane	< 0.1
endosulfan I	< 0.1
pp-DDE	< 0.1
dieldrin	< 0.1
pp-DDD	< 0.1
pp-DDT	< 0.5
endrin	< 0.1
endosulfan II	< 0.1
endrin aldehyde	< 0.1
endosulfan sulphate	< 0.1
endrin ketone	< 0.1
methoxychlor	< 0.2
cis permethrin	< 0.2
trans permethrin	< 0.2

< = Less than limit of detection

AgriQuality New Zealand Limited
Huarangi Aotearoa

Gracefield Road
P.O. Box 31 242
Lower Hutt, New Zealand

Phone: +64 4 570 8800
Facsimile: +64 4 569 4500

03 July 2001

Certificate of Analysis

AgriQuality NEW ZEALAND

Client:	Taranaki Regional Council Private Bag 713 Stratford
Attention:	Gary Bedford
Date Received:	14 June 2001
Client Reference:	4037 A
AgriQuality Lab. Reference:	01-2454/2
Sample Type:	Aqueous
Analysis:	**Acid Herbicide**

Method:

The sample was isolated by solid phase extraction and the extract derivatised with diazomethane. Measurement was performed using gas chromatography - mass spectrometry. Full details of the methodology and precision are available on request.

Results are reported in micrograms per litre (ppb).

Analytical results are for samples as received.

laboratory

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

K. J. Lange
Trace Organics Laboratory
AgriQuality Environmental

M. D. Valentine
Trace Organics Laboratory
AgriQuality Environmental

03 July 2001

SAMPLE DETAILS	
Client Reference	4037 A, Groundwater Bewly Rd, GND0548
AgriQuality Lab. Reference	01-2454/2
Date Sampled	13/06/01
Date Extracted	19/06/01
USEPA Recommended Holding Time	7 days

RESULTS	
Acid Herbicide	**Level (µg/L)**
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 µg/L

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04 July 2001

Certificate of Analysis

AgriQuality NEW ZEALAND

Client:	Taranaki Regional Council Private Bag 713 Stratford
Attention:	Gary Bedford
Date Received:	14 June 2001
Client Reference:	4037 A
AgriQuality Lab. Reference:	01-2454/2
Sample Type:	Aqueous
Analysis:	**Organochlorine Pesticides**

Method:

The sample was extracted with organic solvent and the extract analysed by gas chromatography - mass spectrometry. Detection limits are given for target compounds used to validate the analysis. Full details of the methodology and precision are available on request.

Results are reported in micrograms per litre (ppb).

Analytical results are for samples as received.

laboratory

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

K. J. Lange
Trace Organics Laboratory
AgriQuality Environmental

M. D. Valentine
Trace Organics Laboratory
AgriQuality Environmental

04 July 2001

SAMPLE DETAILS	
Client Reference	4037 A, Groundwater Bewly Rd, GND0548
AgriQuality Lab. Reference	01-2454/2
Date Sampled	13/06/01
Date Extracted	18/06/01
USEPA Recommended Holding Time	7 days

RESULTS	
Organochlorine pesticides	**Level (µg/L)**
hexachlorobenzene	< 1
alpha-BHC	< 1
beta-BHC	< 1
delta-BHC	< 1
lindane	< 1
aldrin	< 1
heptachlor	< 1
heptachlor epoxide	< 1
procymidone	< 2
alpha-chlordane	< 1
gamma-chlordane	< 1
endosulfan I	< 1
pp-DDE	< 1
dieldrin	< 1
pp-DDD	< 1
pp-DDT	< 2
endrin	< 1
endosulfan II	< 1
endrin aldehyde	< 1
endosulfan sulphate	< 1
endrin ketone	< 1
methoxychlor	< 2
cis permethrin	< 2
trans permethrin	< 2

< = Less than limit of detection

10/08 '01 FRI 15:36 FAX

AgriQuality New Zealand Limited
H...angi Aotearoa

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02 August 2001

Certificate of Analysis

Client:	Taranaki Regional Council Private Bag 713 Stratford
Attention:	Fiona Putt
Date Received:	11 May 2001
Client Reference:	011011, 011013, 011014
AgriQuality Lab. Reference:	01-1932/1,3,4
Sample Type:	Shellfish
Analysis:	**Acid Herbicide**

Method:

The sample was isolated by solid phase extraction and the extract derivatised with diazomethane. Measurement was performed using gas chromatography - mass spectrometry. Full details of the methodology are available on request.

Results are reported in milligrams per kilogram (ppm).

Analytical results are for samples as received.

K. J. Langc
UltraTrace™ Laboratory
AgriQuality Environmental

for M. D. Valentine
UltraTrace™ Laboratory
AgriQuality Environmental

02 August 2001

SAMPLE DETAILS	
Client Reference	011011, Kawarou Reef, 08/05/01
AgriQuality Lab. Reference	01-1932/1

RESULTS	
Acid Herbicide	Level (mg/kg)
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 mg/kg

02 August 2001

SAMPLE DETAILS	
Client Reference	011013, Wairoka 'cavern', 08/05/01
AgriQuality Lab. Reference	01-1932/3

RESULTS	
Acid Herbicide	Level (mg/kg)
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 mg/kg

02 August 2001

SAMPLE DETAILS	
Client Reference	011014, Waireka 'control', 08/05/01
AgriQuality Lab. Reference	01-1932/4

RESULTS	
Acid Herbicide	Level (mg/kg)
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 mg/kg

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Lower Hutt, New Zealand

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23 July 2001

Certificate of Analysis

AgriQuality NEW ZEALAND

Client: Taranaki Regional Council
Private Bag 713
Stratford

Attention: Gary Bedford

Date Received: 13 July 2001

Client Reference: 4062-4069

HAND DELIVERED 27/7/01
ORIGINAL GIVEN TO Gary
COPY IN MAIL DATED 30/7/01
Kay (Signed)

AgriQuality Lab. Reference: 01-2885/1-8

Sample Type: Aqueous

Analysis: **Acid Herbicide**

Method:

The sample was isolated by solid phase extraction and the extract derivatised with diazomethane. Measurement was performed using gas chromatography - mass spectrometry. Full details of the methodology and precision are available on request.

Results are reported in micrograms per litre (ppb).

Analytical results are for samples as received.

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

K. J. Lange
Trace Organics Laboratory
AgriQuality Environmental

M. D. Valentine
Trace Organics Laboratory
AgriQuality Environmental

23 July 2001

SAMPLE DETAILS	
Client Reference	4062, DAS Bore 21
AgriQuality Lab. Reference	01-2885/1
Date Sampled	12/07/01
Date Extracted	19/07/01
USEPA Recommended Holding Time	7 days

RESULTS	
Acid Herbicide	Level (µg/L)
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 µg/L

23 July 2001

SAMPLE DETAILS	
Client Reference	4063, DAS Bore 43
AgriQuality Ltd, Reference	01-2885/2
Date Sampled	12/07/01
Date Extracted	19/07/01
USEPA Recommended Holding Time	7 days

RESULTS	
Acid Herbicide	Level (µg/L)
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	0.1

ND The letters ND mean "not detected" above the detection limit of 0.1 µg/L

23 July 2001

SAMPLE DETAILS	
Client Reference	4064, DAS Bore 49A
AgriQuality Lab. Reference	01-2885/3
Date Sampled	12/07/01
Date Extracted	19/07/01
USEPA Recommended Holding Time	7 days

RESULTS	
Acid Herbicide	Level (ug/L)
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	0.1
bentazone	ND
fenoprop	0.2
picloram	0.6

ND The letters ND mean "not detected" above the detection limit of 0.1 µg/L

23 July 2001

SAMPLE DETAILS	
Client Reference	4065, DAS Bore 1
AgriQuality Lab Reference	01-2885/4
Date Sampled	12/07/01
Date Extracted	19/07/01
USEPA Recommended Holding Time	7 days

RESULTS	
Acid Herbicide	Level (µg/L)
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 µg/L

23 July 2001

SAMPLE DETAILS	
Client Reference	4066, DAS Bore 3
AgriQuality Lab. Reference	01-2885/5
Date Sampled	12/07/01
Date Extracted	19/07/01
USEPA Recommended Holding Time	7 days

RESULTS	
Acid Herbicide	Level (µg/L)
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 µg/L

23 July 2001

SAMPLE DETAILS	
Client Reference	4067, DAS Bore 4
AgriQuality Lab: Reference	01-2885/6
Date Sampled	12/07/01
Date Extracted	19/07/01
USEPA Recommended Holding Time	7 days

RESULTS	
Acid Herbicide	Level (µg/L)
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	ND

ND The letters ND mean "not detected" above the detection limit of 0.1 µg/L

23 July 2001

SAMPLE DETAILS	
Client Reference	4068, DAS Bore 6
AgriQuality Lab. Reference	01-2885/7
Date Sampled	12/07/01
Date Extracted	19/07/01
USEPA Recommended Holding Time	7 days

RESULTS	
Acid Herbicide	Level (µg/L)
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	16

ND The letters ND mean "not detected" above the detection limit of 0.1 µg/L

23 July 2001

SAMPLE DETAILS	
Client Reference	4069, DAS Bore 46A
AgriQuality Lab. Reference	01-2885/8
Date Sampled	12/07/01
Date Extracted	19/07/01
USEPA Recommended Holding Time	7 days

RESULTS	
Acid Herbicide	Level (µg/L)
mecoprop	0.4
MCPA	1.2
dichlorprop	ND
2,4-D	1.3
triclopyr	ND
MCPB	0.1
2,4,5-T	0.6
2,4-DB	0.6
bentazone	ND
fenoprop	0.4
picloram	11

ND The letters ND mean "not detected" above the detection limit of 0.1 µg/L

CLNZ94\ 01-2885 ah aq

10/08 '01 FRI 15:35 FAX 001

AgriQuality New Zealand Limited
Hauarangi Aotearoa

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Lower Hutt, New Zealand

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08 August 2001

Certificate of Analysis

AgriQuality NEW ZEALAND

Client:	Taranaki Regional Council Private Bag 713 Stratford
Attention:	Gary Bedford
Date Received:	13 July 2001
Client Reference:	4068
AgriQuality Lab. Reference:	01-2885/7
Sample Type:	Aqueous
Analysis:	**Acid Herbicide**

10/8/01
Gary
13/8/01

Method:

The sample was isolated by solid phase extraction and the extract derivatised with diazomethane. Measurement was performed using gas chromatography - mass spectrometry. Full details of the methodology and precision are available on request.

Results are reported in micrograms per litre (ppb).

Analytical results are for samples as received.

laboratory
All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

K. J. Lange
UltraTrace™ Laboratory
AgriQuality Environmental

M. D. Valentine
UltraTrace™ Laboratory
AgriQuality Environmental

08 August 2001

SAMPLE DETAILS	
Client Reference	4068, DAS Bore 6
AgriQuality Lab. Reference	01-2885/7, repeat extraction
Date Sampled	12/07/01
Date Extracted	01/08/01
USEPA Recommended Holding Time	7 days

RESULTS	
Acid Herbicide	Level (µg/L)
mecoprop	ND
MCPA	ND
dichlorprop	ND
2,4-D	ND
triclopyr	ND
MCPB	ND
2,4,5-T	ND
2,4-DB	ND
bentazone	ND
fenoprop	ND
picloram	9.1

ND The letters ND mean "not detected" above the detection limit of 0.1 µg/L

15/06 '01 FRI 15:30 FAX

AgriQuality New Zealand Limited
Hua rangi Aotearoa

Gracefield Research Centre
Gracefield Road
PO Box 30 547
Lower Hutt
New Zealand

AgriQuality Environmental
Phone: 64 4 570 6822
Fax: 64 4 569 4500

Email: <allwoodj@agriquality.co.nz>

Facsimile

AgriQuality NEW ZEALAND

To: Gary Bedford Fax: 06 765 5097

Company: Taranaki Regional Council Date: June 15, 2001

From: Jacinda Allwood Pages (including this page): 3

Re: Sample for Acid Herbicide analysis and 2378-TCDD analysis (01-1545).

Dear Gary,

Please find following the analytical report for the 2378-TCDD analysis your aqueous sample received by AgriQulaity Environmental on the 18th April 2001. The sample was analysed for 2378-TCDD and Acid Herbicides (AHs), which you were faxed the results on the 30th May.

The top copies of the two certificates and the invoice relating to this work will follow shortly by post.

If you have any queries please do not hesitate to contact me.

Kind regards

Jacinda Allwood
Team Leader
UltraTrace™ Laboratory
AgriQuality Environmental

HAND DELIVERED 15,6,01
ORIGINAL GIVEN TO Gary
IN MAIL DATED 18/6/01
Kay (Signed)

AgriQuality New Zealand Limited
Ruarangi Aotearoa
Gracefield Road
P.O. Box 31 242
Lower Hutt, New Zealand
Phone: +64 4 570 6800
Facsimile: +64 4 569 4500

15 June 2001

Certificate of Analysis

Client: Taranaki Regional Council
Private Bag 713
Stratford
New Zealand

Attention: Gary Bedford

Date Received: 18 April 2001

Laboratory Reference: 01-1545

Sample Type: Aqueous

Analysis: **2378 Tetrachlorodibenzo-*p*-dioxin (TCDD)**

Method: Based on USEPA Method 1613 (Isotope Dilution)

The sample was spiked with isotopically labelled surrogate standards and extracted with organic solvent. The extract was purified by chemical treatment and solid phase chromatographic techniques. Measurement was performed using high resolution gas chromatography and high resolution electron impact mass spectrometry.

Results are reported in picograms per litre (pg/L), equivalent to ppq, on an as received basis to two significant figures. Results have been corrected for recoveries.

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

S V Leathem
UltraTrace™ Laboratory
AgriQuality Environmental

M L Mackey
UltraTrace™ Laboratory
AgriQuality Environmental

15 June 2001

Results

Laboratory Reference	Sample Identification	Sample Type	TCDD† pg/L	$^{13}C_{12}$ RE %
01-1545/1	010904, Wairoka Point Rock Pool	Aqueous	< 8	75

† = Results are reported on an as received basis.

Abbreviations:

CDD = chlorodibenzo-*p*-dioxin
T = tetra
$^{13}C_{12}$ RE = recovery of $^{13}C_{12}$ surrogate standard
pg/L = picograms per litre (equivalent to ppq)
ppq = parts per quadrillion
< = less than limit of detection (LOD)

01-1545 tedd

AgriQuality New Zealand Limited
Huarangi Aotearoa

Gracefield Research Centre
Gracefield Road
PO Box 30 547
Lower Hutt
New Zealand

AgriQuality Environmental
Phone: 64 4 570 8610
Fax: 64 4 569 4500

Email: <mackeym@agriquality.co.nz>

Facsimile

To: Gary Bedford — Fax: 06 765 5097

Company: Taranaki Regional Council — Date: August 15, 2001

From: Moana Mackey — Pages (including this page): 3

Dear Gary,

Please find following the results for your soil sample, received by AgriQuality on the 14th of June 2001, and analysed for 2378-TCDD.

Results are reported as picograms per gram (pg/g), equivalent to ppt, on an as received basis.

You should receive the top copy of the analytical certificate shortly by post.

If you have any queries please do not hesitate to contact me.

Kind regards

Moana Mackey
UltraTrace™ Laboratory
AgriQuality Environmental

16 8 01
Gary
16 8 01

Kay

AgriQuality New Zealand Limited
Huarangi Aotearoa

Gracefield Road
P.O. Box 31 242
Lower Hutt, New Zealand

Phone: +64 4 570 5600
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13 August 2001

Certificate of Analysis

Client: Taranaki Regional Council
Private Bag 713
Stratford
New Zealand

Attention: Gary Bedford

Date Received: 14 June 2001

Laboratory Reference: 01-2454

Sample Type: Soil

Analysis: **2378 Tetrachlorodibenzo-*p*-dioxin (TCDD)**

Method: Based on USEPA Method 1613A (Isotope Dilution)

The sample was spiked with isotopically labelled surrogate standards and extracted with organic solvent. The extract was purified by chemical treatment and solid phase chromatographic techniques. Measurement was performed using high resolution gas chromatography and high resolution electron impact mass spectrometry.

Results are reported in picograms per gram (pg/g), equivalent to ppt to two significant figures, on a dry weight basis. Results have been corrected for recoveries.

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

S V Leathem
UltraTrace™ Laboratory
AgriQuality Environmental

M L Mackey
UltraTrace™ Laboratory
AgriQuality Environmental

13 August 2001

Results

Laboratory Reference	Sample Identification	Sample Type	TCDD† pg/g	$^{13}C_{12}$ RE %
01-2454/8	4043 - Holt Road Soil 2	Soil	< 9	98

† = Results are reported on a dry weight basis.

Abbreviations:

CDD = chlorodibenzo-*p*-dioxin
T = tetra
$^{13}C_{12}$ RE = recovery of $^{13}C_{12}$ surrogate standard

pg/g = picograms per gram (equivalent to ppt)
ppt = parts per trillion
< = less than limit of detection (LOD)

01-2454 todd

AgriQuality New Zealand Limited
Hua rangi Aotearoa

Gracefield Research Centre
Gracefield Road
PO Box 30 547
Lower Hutt
New Zealand

AgriQuality Environmental
Phone: 64 4 570 8510
Fax: 64 4 569 4500

Email: <mackeym@agriquality.co.nz>

Facsimile

AgriQuality NEW ZEALAND

To: John Williams — Fax: 06 765 5097

Company: Taranaki Regional Council — Date: August 15, 2001

From: Moana Mackey — Pages (including this page): 3

Dear Gary,

Please find following the results for your eight aqueous samples, received by AgriQuality on the 13th of July 2001, and analysed for 2378-TCDD.

Results are reported as picograms per litre (pg/L), equivalent to ppq, on an as received basis.

You should receive the top copy of the analytical certificate shortly by post.

If you have any queries please do not hesitate to contact me.

Kind regards

15/8/01
John W
16/8/01

Moana Mackey
UltraTrace™ Laboratory
AgriQuality Environmental

HAND DELIVERED

okay

15/08/01 14:30 AGRIQUALITY NZ LTDNEW ZEALAND → +64 6 765 5097 P01

AgriQuality New Zealand Limited
Hunrangi Aotearoa

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Lower Hutt, New Zealand

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15 August 2001

Certificate of Analysis

Client: Taranaki Regional Council
Private Bag 713
Stratford
New Zealand

Attention: John Williams

Date Received: 13 July 2001

Laboratory Reference: 01-2885

Sample Type: Aqueous

Analysis: **2378 Tetrachlorodibenzo-*p*-dioxin (TCDD)**

Method: Based on USEPA Method 1613 (Isotope Dilution)

The samples were spiked with isotopically labelled surrogate standards and extracted with organic solvent. The extracts were purified by chemical treatment and solid phase chromatographic techniques. Measurement was performed using high resolution gas chromatography and high resolution electron impact mass spectrometry.

Results are reported in picograms per litre (pg/L), equivalent to ppq to two significant figures, on as received basis. Results have been corrected for recoveries.

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

S V Leathem
UltraTrace™ Laboratory
AgriQuality Environmental

M L Mackey
UltraTrace™ Laboratory
AgriQuality Environmental

15 August 2001

Results

Laboratory Reference	Sample Identification	Sample Type	TCDD pg/L	TCDD $^{13}C_{12}$ RE
01-2885/1	4062-DAS Bore 21	Aqueous	< 3	87
01-2885/2	4063-DAS Bore 43	Aqueous	< 3	76
01-2885/3	4064-DAS Bore 49A	Aqueous	< 20	58
01-2885/4	4065-DAS Bore 1	Aqueous	< 9	38
01-2885/5	4066-DAS Bore 3	Aqueous	< 4	89
01-2885/6	4067-DAS Bore 4	Aqueous	< 2	98
01-2885/7	4068-DAS Bore 6	Aqueous	< 2	95
01-2885/8	4069-DAS Bore 46A	Aqueous	< 10	42

† = Results are reported on an as received basis.

Abbreviations:

CDD = chlorodibenzo-*p*-dioxin
T = tetra
$^{13}C_{12}$ RE = recovery of $^{13}C_{12}$ surrogate standard
pg/L = picograms per litre (equivalent to ppq)
ppq = parts per quadrillion
< = less than limit of detection (LOD)

01-2885 tedd

AgriQuality New Zealand Limited
Huarangi Aotearoa

Gracefield Road
P.O. Box 31 242
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Clean RD. Landfill P3/19/3

RECEIVED
15 FEB 2001

2 6 FEB 2001

AgriQuality NEW ZEALAND

14 February 2001

Client Ref: 16288B
AgriQuality Ref: 01-0124

New Plymouth District Council
Works and Services Department
Private Bag 2025
New Plymouth

Attention: Graham Morris

Dear Graham

Please find enclosed the top copy of the analytical certificate for your aqueous sample, received by AgriQuality Environmental on the 12th of January 2001, and analysed for polychlorinated dibenzo-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs).

Results are reported as picograms per litre (pg/L), equivalent to ppq, on an as received basis. The total toxic equivalence (I-TEQ) was calculated using international toxic equivalency factors (I-TEFs).

Also enclosed for your attention is the invoice for this work.

If you have any queries or require any additional information, please do not hesitate to contact us.

Kind regards

Moana Mackey
UltraTrace™ Laboratory
AgriQuality Environmental

AgriQuality New Zealand Limited
Huarangi Aotearoa

Gracefield Road
P.O. Box 31 242
Lower Hutt, New Zealand

Phone: +64 4 570 8800
Facsimile: +64 4 569 4500

14 February 2001

Certificate of Analysis

Client:	New Plymouth District Council Works and Services Department Private Bag 2025 NEW PLYMOUTH 4620
Attention:	Graham Morris
Date Received:	12 January 2001
Laboratory Reference:	01-0124
Sample Type:	Aqueous
Analysis:	**Polychlorinated dibenzo-*p* -dioxins (PCDDs)** **Polychlorinated dibenzofurans (PCDFs)**
Method:	Based on USEPA Method 1613 (Isotope Dilution)

The samples were spiked with isotopically labelled surrogate standards and extracted with organic solvent. The extracts were purified by chemical treatment and solid phase chromatographic techniques. Measurement was performed using high resolution gas chromatography with high resolution electron impact mass spectrometry.

Results are reported in picograms per litre (pg/L), equivalent to ppq, on an as received basis to two significant figures. Results have been corrected for recoveries. The sum of PCDDs and PCDFs is calculated and reported both excluding limit of detection (LOD) values and including half the LOD values to three significant figures.

The total toxic equivalence (I-TEQ) was calculated for each sample using international toxic equivalency factors (I-TEFs). For non-detected congeners, half the value of the level is used in the I-TEQ calculation. The total I-TEQ level is reported both excluding LOD values and including half the LOD values to three significant figures.

IANZ endorsement applies only to the application of an approved analytical method for the determination of PCDDs and PCDFs in these samples.

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

S V Leathem
UltraTrace™ Laboratory
AgriQuality Environmental

M L Mackey
UltraTrace™ Laboratory
AgriQuality Environmental

14 February 2001

Sample Details:

Sample Identification	Laboratory Reference	Sample Type
1, Colson Road Landfill Leachate	01-0124/1	Aqueous
2, Cook Street Landfill Leachate	01-0124/2	Aqueous

Abbreviations:

CDD	= chlorodibenzo-*p*-dioxin	I-TEF	= International toxic equivalency factor
CDF	= chlorodibenzofuran	I-TEQ	= International toxic equivalence
T	= tetra	$^{13}C_{12}$ RE	= recovery of $^{13}C_{12}$ surrogate standard
Pe	= penta	pg/L	= picograms per litre (equivalent to ppq)
Hx	= hexa	ppq	= parts per quadrillion
Hp	= hepta	<	= less than limit of detection (LOD)
O	= octa		

14 February 2001

Results

Laboratory Reference: 01-0124/1

Sample Identification: 1, Colson Road Landfill Leachate

PCDD/PCDF Congener	Level† pg/L	I-TEF	I-TEQ pg/L	$^{13}C_{12}$ RE %
2378 TCDF	< 2	0.1	0.1	75
Non 2378 TCDF	< 6	0	0	
2378 TCDD	< 2	1	1	77
Non 2378 TCDD	< 4	0	0	
12378 PeCDF	< 1	0.05	0.025	75
23478 PeCDF	< 1	0.5	0.25	72
Non 2378 PeCDF	< 2	0	0	
12378 PeCDD	< 3	0.5	0.75	68
Non 2378 PeCDD	< 3	0	0	
123478 HxCDF	< 1	0.1	0.05	69
123678 HxCDF	< 1	0.1	0.05	70
234678 HxCDF	< 1	0.1	0.05	81
123789 HxCDF	< 1	0.1	0.05	78
Non 2378 HxCDF	< 1	0	0	
123478 HxCDD	< 2	0.1	0.1	90
123678 HxCDD	< 2	0.1	0.1	85
123789 HxCDD	< 2	0.1	0.1	
Non 2378 HxCDD	< 2	0	0	
1234678 HpCDF	< 3	0.01	0.015	61
1234789 HpCDF	< 1	0.01	0.005	81
Non 2378 HpCDF	< 4	0	0	
1234678 HpCDD	< 6	0.01	0.03	72
Non 2378 HpCDD	< 10	0	0	
OCDF	< 5	0.001	0.0025	
OCDD	< 7	0.001	0.0035	85

Sum of PCDD and PCDF congeners:	Excluding LOD values	0	pg/L
	Including half LOD values	36.5	pg/L
Total I-TEQ:	Excluding LOD values	0	pg/L
	Including half LOD values	2.68	pg/L

† = Results are reported on an as received basis.

01-0124 dx

14 February 2001

Results

Laboratory Reference: 01-0124/2

Sample Identification: 2, Cook Street Landfill Leachate

PCDD/PCDF Congener	Level† pg/L	I-TEF	I-TEQ pg/L	$^{13}C_{12}$ RE %
2378 TCDF	< 0.9	0.1	0.045	76
Non 2378 TCDF	< 4	0	0	
2378 TCDD	< 2	1	1	87
Non 2378 TCDD	9.3	0	0	
12378 PeCDF	< 0.9	0.05	0.0225	88
23478 PeCDF	< 1	0.5	0.25	82
Non 2378 PeCDF	< 1	0	0	
12378 PeCDD	< 2	0.5	0.5	85
Non 2378 PeCDD	< 2	0	0	
123478 HxCDF	< 1	0.1	0.05	89
123678 HxCDF	< 1	0.1	0.05	87
234678 HxCDF	< 1	0.1	0.05	93
123789 HxCDF	< 1	0.1	0.05	91
Non 2378 HxCDF	< 1	0	0	
123478 HxCDD	< 2	0.1	0.1	106
123678 HxCDD	< 2	0.1	0.1	95
123789 HxCDD	< 2	0.1	0.1	
Non 2378 HxCDD	< 2	0	0	
1234678 HpCDF	< 2	0.01	0.01	68
1234789 HpCDF	< 1	0.01	0.005	74
Non 2378 HpCDF	< 2	0	0	
1234678 HpCDD	< 4	0.01	0.02	73
Non 2378 HpCDD	< 4	0	0	
OCDF	< 4	0.001	0.002	
OCDD	< 20	0.001	0.01	73

Sum of PCDD and PCDF congeners:	Excluding LOD values	9.30	pg/L
	Including half LOD values	41.2	pg/L
Total I-TEQ:	Excluding LOD values	0	pg/L
	Including half LOD values	2.36	pg/L

† = Results are reported on an as received basis.

01-0124 dx

Marfell Park, New Plymouth, Environmental Investigation

ĩ Prepared for
Taranaki Regional Council

ĩ August 2009

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Directed and approved by

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Graeme Proffitt

Limitations:

This report has been prepared on the basis of historical information and visual observations during the gathering of soil samples, drilling of auger holes and the analysis of 14 composite soil samples for a wide range of organic compounds and a suite of eight heavy metals. The information has been used to describe the ground conditions in the vicinity of the soil sample locations. The conditions away from these locations are unknown and should not be extrapolated from the results of this study without further investigation.

The information contained within this letter applies to the date of the site investigation (July 2009). With time, the site conditions or environmental guidelines could change so that the reported assessment and conclusions are no longer valid. Thus, in the future, the report should not be used without confirming the validity of the report's information at that time.

The report has been prepared for the Taranaki Regional Council, according to their instructions, for the particular objectives described in the report. The information contained in the report should not be used by anyone else or for any other purposes.

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Executive Summary

Laying of stormwater pipes by contractors at the northern end of New Plymouth's Marfell Park in May 2009 encountered the remains of two crushed drums with a small amount of chemical residue. The residues were found amongst decomposed municipal waste. The Taranaki Regional Council (TRC) sampled the residues and found high concentrations of chemicals formerly used for the manufacture of phenoxy herbicides. The residues also had elevated concentrations of the dioxin 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD).

The discovery of the chemical residues raised concerns within the community that there could be general dioxin and other contamination within the landfill underlying the park. Park users were concerned that they or their children might be exposed to such contamination in their day-to-day use of the park, particularly as there was a children's playground close to the original discovery. As a result of the community concerns, the Regional Council commissioned Pattle Delamore Partners Limited to carry out a soil sampling investigation in the vicinity of the playground, a nearby BMX track and in the wider park.

The aim of the investigation was to confirm or otherwise that there is a minimal level of contamination in surface soils and therefore a minimal risk to users of the park. Assessing the risk was achieved by:

1. Determining the thickness of soil cover over the old waste
2. Sampling surface soil for laboratory analysis of chemical contaminants, with the focus on TCDD, but a variety of other contaminants was also assessed.
3. Sampling waste material in selected locations.

The park was divided into four areas for the purposes of investigation; the main park area consisting of former sports fields on the upper two levels of the park, the BMX track, the children's playground and the nearby area where the chemical residues were originally discovered. Samples were taken from 85 locations, mainly from the surface but including 30 deeper samples, and analysed as 14 composite samples to obtain an estimate of average concentrations over the areas represented by the composites. Assessing potential hotspots was not the aim the investigation.

Analysis of soil samples found only low concentrations of a wide range of organic compounds and a suite of eight metals. Concentrations of contaminants within old landfill waste samples were at the lower end of typical landfill material. There was generally little evidence of man-made contamination of surface soil in the locations sampled. A few samples had low concentrations of some pesticides, but there was a general absence of compounds historically used to manufacture the herbicide 2,4,5-T. The soil samples also had low dioxin concentrations. The composite sample with the highest dioxin concentrations was taken from the surface of the backfill in the new stormwater trench running through the playground.

Comparison of the sample analysis results with soil guideline values showed that all sampled locations present minimal risk to park users. This includes risk from dioxins. In addition, soil cover over the historic landfill material was generally found to be providing an adequate barrier to contact with the underlying waste, although additional cover in the vicinity of the “drum excavation” is recommended. Overall, the park is suitable for its current use.

While contaminant concentrations in the underlying waste were found to comply with soil guideline values, indicating minimal risk even if the material was brought to the surface, it is expected that the waste is variable from place to place. Contaminant hotpots can be expected. Accordingly, it is recommended that excavation into the waste is avoided or carefully managed.

If excavation into the waste cannot be avoided, then care should be taken to minimising spreading of waste on the surface or mixing with clean soil. Waste should be reburied under an adequate cover layer of clean soil, or, preferably, be disposed of to a landfill or other licensed facility. It is recommended that a management plan be developed to control excavation and guard against inappropriate soil disposal.

1.0 Introduction

Laying of stormwater pipes by contractors to the New Plymouth District Council (NPDC) at the northern part of Marfell Park, New Plymouth, in May 2009 encountered the remains of two crushed drums with a small amount of chemical residue about 2 m below the surface. The residues were found amongst decomposed municipal waste. The park is constructed on a closed landfill, with the location of the stormwater works close to a children's playground and a BMX track.

The Taranaki Regional Council (TRC) sampled the residues and found high concentrations of chemicals formerly used for the manufacture of phenoxy herbicides. The residues also had elevated concentrations of the dioxin 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD).

The discovery of the chemical residues raised concerns within the community that there could be general dioxin and other contamination within the landfill and that this contamination could also be affecting the surface of the park. Park users were concerned that they or their children might be exposed to such contamination in their day-to-day use of the park. As a result of the community concerns, the Regional Council commissioned Pattle Delamore Partners Limited (PDP) to carry out a soil sampling investigation in the vicinity of the playground, the BMX track and the wider park. This report describes the background to and results of the investigation.

The overall aim of the investigation was to confirm or otherwise that there is a minimal level of contamination in surface soils and therefore a minimal risk to users of the park. If contaminant levels are excessive, then a subsidiary aim was to determine ways of managing the risk. Assessing the risk was to be achieved by:

4. Determining the thickness of soil cover over the waste under the park, as a means of assessing the likelihood of waste being exposed at the surface at the particular locations.

5. Sampling surface soil for laboratory analysis of chemical contaminants to assess the current risk. The focus was on the dioxin 2,3,7,8-TCDD, but a variety of contaminants, both typical of landfills in general but also specific to the earlier discovery, were also to be assessed.

6. Sampling soil from the surface of the waste material in selected locations to assess whether the waste most likely to be exposed in future (i.e. the waste immediately under the soil cover) has significant contaminant concentrations, as a measure of the potential future risk if excavation were to occur.

The investigation was carried out at a screening level, that is, at a sufficient level of detail to provide reasonable confidence that compliance with soil guideline values would mean that further investigation is not required. In addition, the investigation was not aimed at finding hotspot locations within the waste, rather than average concentrations in areas of interest.

2.0 Background to the Investigation

On 7 May 2009, a contractor working for NPDC excavated the corroded remnants of two drums during excavation of a trench across the bottom (northern end) of Marfell Park. The trench, for a new stormwater pipe, was partially excavated through old landfill waste over a distance of about 30 m. The drum remnants were found at a depth of about 2 m.

One drum remnant had a characteristic agrichemical smell. The contractor immediately stopped work and contacted both the District and Regional councils. The Regional Council collected six samples of the residues within the drums and of surrounding soil, over a distance of about seven metres of the excavated soil. The volume of chemical residue was a few litres of caked crystalline material.

The District Council immediately removed the drum remnants, the chemical residue and approximately 80 m^3 of excavated soil and rubbish to the Colson Road Regional landfill, which is a secure landfill operated by the District Council. The excavation site was secured while the samples were analysed by AssureQuality for chlorophenols, a multi-residue screen and the dioxin2,3,7,8-TCDD[1].

One sample contained high concentrations of tetrachlorobenzene (17%) and trichlorophenol (27%). A second sample had about 3% of each of these two chemicals (see http://www.trc.govt.nz/environment/waste/marfell.htm#analyses). The other four samples, which were of the surrounding soil, were below the analytical detection limit for these compounds.

Both these chemicals are used as raw materials for the manufacture of the phenoxy herbicide 2,4,5-trichlorophenoxyacetic acid (2,4,5-T). 2,4,5-T was formerly manufactured by a predecessor of Dow AgroSciences (NZ) Limited (DAS), which has a manufacturing plant at Paritutu, New Plymouth. Discussions with DAS suggest that the residues probably came from the Paritutu plant some time between 1969, when tetrachlorobenzene (TCB) was first used at the plant to manufacture trichlorophenol (TCP), and 1974, when the company had its own secure landfill (Andrew Symes, pers.comm.). None of the samples were found to contain 2,4,5-T.

The dioxin 2,3,7,8-TCDD is a known contaminant of TCP and 2,4,5-T. The analysis of the most concentrated chemical residue was found to contain 2.9 ppm[2] TCDD, and the second chemical residue sample 0.45 ppm. The levels in the other four soil samples were 1,000 to 10,000 times lower.

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[1] The most toxic of a family of 210 polychlorinated dibenzo-p-dioxin (PCDD) and polychlorinated dibenzofuran (PCDF) congeners. Most PCDD and PCDF congeners are thought to be of no toxicological significance, however, the 17 congeners with chlorine atoms substituted in the 2,3,7,8-positions are thought to pose a risk to human and environmental health. 2,3,7,8-TCDD is commonly known simply as dioxin.

[2] ppm = parts per million by weight, or mg/kg

Small concentrations of some other organic pesticide compounds (including the organophosphate insecticide dichlofenthion) were also detected but these are not of concern at the concentrations found.

The District and Regional councils decided to carry out further investigations to determine whether the discovery of the residues was an indication that it was the location of one of the historical drum dump sites that had raised public concern in 1999/2000. A second round of investigations on Friday 29 May 2009 involved probing of the wastes and soil in the immediate vicinity of where the drum remnants were recovered. The remains of a further seven containers were found, some of which contained a crystalline residue but none had the characteristic agrichemical odours of the earlier discovery. The drum remains were recovered and removed to Colson Road landfill, along with approximately 100 cubic metres of rubbish and soil. The site was reinstated by the District Council, including capping with a layer of clean clay to at least one metre deep.

Given the public concern, the Regional Council decided to commission further investigations to determine whether park users were at risk from residues within the landfill waste. A preliminary review of the potential risks was prepared and a sampling plan (PDP, 2009) was developed in conjunction with community members, the Taranaki District Health Board and the District and Regional councils.

The sample design is described in more detail in Section 4.0.

3.0 Site Description and History

The following description has been derived from information provided by NPDC and TRC staff, the New Plymouth BMX Club, local residents and a site walkover on 19 June 2009.

Marfell Park is located on a former municipal landfill. The landfill operated from the early 1950s until 1976. It is expected to contain waste typical of the period, including domestic and industrial waste from throughout New Plymouth. It is probable some hazardous waste was disposed of in the landfill as there were few restrictions on landfill disposal when the landfill operated. Such landfill disposal was typical throughout New Zealand at the time.

The landfill was closed in 1976 and was subsequently developed into the park, which has a children's playground, skateboard park, BMX track and two former sports field areas that now have casual use.

The park (see Figure 1) has an area in excess of 6 ha and is formed on top of the landfill which filled a south to north trending gully on three levels. The depth of fill is unknown, but judging by the current topography is perhaps 20 m or more deep in the deepest parts of the upper two levels of the park. If so, the volume of landfill is expected to be at least several hundred thousand cubic metres. The park is bounded by the remnants of the gully walls which slope steeply up to Marfell School and residential properties on Endeavour Street to the west and residential properties on Cook Street to the east.

The top level of the park (Photograph 1) has an area of about 3.3 ha and the intermediate level (Photograph 2) has an area of about 1 ha. Combined, these two areas make up the majority of the park, but these areas are perhaps the least intensively used. Both are grassed areas originally developed as sports fields but no longer used for that purpose. The sports fields were developed jointly in 1977/78 by the then New Plymouth City Council and the Education Department for use by the adjacent Marfell School and as rugby fields by a local club. The landfill material was capped with imported soil and perimeter surface drains installed. Not surprisingly, the fields were a maintenance problem due to settlement and the council routinely imported truckloads of soil every year to deal with hollows that developed. The school ceased using the playing fields, except occasionally, from the mid-1980s, following a drop in the school roll.

The park was converted to soccer fields in 1991 and was also used for softball. The park was upgraded in 1995 for the then New Plymouth City Football Club but the club went out of existence and the upgraded park was not used for organised sport from that point on. The clubrooms fell into disrepair and were demolished last year.

The middle and upper levels of the park now have a slightly undulating surface as a result of further settlement and are unsuitable for sports use. They are used in a casual way by local residents and as a thoroughfare, including by children going to and from school. The local school seldom uses the park except for "Clean-up Marfell" events each term. The most regular users of the upper part of the park are probably skate boarders, who use a skate park at the southern end of the park. The skate park is constructed of

concrete on slightly higher natural ground. Being on natural ground users of the skate park are at no particular risk from soil contaminants.

The lower level of the park is very roughly triangular, narrowing towards the main entranceway off Grenville Street, and has an area of about 1.6 ha. A further entrance is up a grassed slope off Cook Street. The lower level is occupied, south to north, by a BMX track (Photograph 3) immediately below the terrace face of the intermediate level of the park, a carpark for the BMX track, a grassed area on which is located a children's playground (photographs 4 and 6), and a sealed accessway past the playground to the carpark.

While the main landfill is reported to be south of the BMX track (starting at the terrace face immediately south of the BMX track), BMX club members report that there is waste material at shallow depth below the lowest parts of the track. The majority of the BMX track has been built up with at least 1 m and typically several metres of imported fill to create the undulating gravel-surfaced track itself and grassed areas in between.

Waste was also encountered in the recently excavated stormwater pipe trench (Photograph 5) from immediately south of the carpark to partway to where the trench intersects the entrance road. This would put the northern extent of the waste somewhere within the playground. Land further north towards the park entrance, including under part of the playground, probably does not have waste material under it. It can be assumed that waste extends under the gravel-surfaced carpark. The waste under the lower part of the park is probably shallow, a few metres at most where it fills the base of the former gully, thinning towards the north.

The excavation in which the chemical residues were found is located between the children's playground and the BMX carpark. The residues were found between the base of a tree and a new manhole installed during the stormwater works (photographs 4 and 5).

4.0 Investigation Description

4.1 Sampling Strategy

The aim of the field sampling programme was to undertake a screening level assessment to determine if further investigations are required at Marfell Park. Due to the high cost of analysis of dioxin residues, only a limited number of samples could be collected. The aim of the investigation was not to find hotspot locations or to determine the spatial characteristics of any potential contamination within the waste, but rather to provide an assessment of the average exposure to site users. Therefore, the site has been divided into four main areas, with each area sampled to satisfy particular data quality objectives, as outlined in the Marfell Park Sampling Plan (PDP, 2009).

The areas are:

- the former sports field areas on the upper and middle park levels
- the BMX track
- the children's playground
- local areas where excavation is known to have been carried out, including the recent stormwater pipe excavation, a stormwater pipe installed near the BMX track and any other areas of significant excavation that have come to light before the commencement of sampling.

The sampling procedure or each of the individual areas is detailed below. The sampling was carried out on 13 – 16 July 2009.

4.2 Park Upper and Middle Levels

The upper and middle levels of the park are no longer used for organised sport, but are used informally for low intensity activities and as a thoroughfare by locals. Exposure to soil is expected to be limited and infrequent.

The intent of the investigation of the upper and middle is three-fold:

- to find average concentrations of the parameters analysed across the complete area of surface soil, being representative of a typical person's exposure
- to assess the depth of soil cover to waste
- to determine concentrations of contaminants typical of the waste, which is expected to be similar throughout the landfill

As average concentrations are of interest and for reasons of economy, a composite sampling approach was used. Because of the irregular boundaries of the upper and middle levels, a random stratified sampling approach consisting of six approximately equal areas with four random sample locations selected from each equal area was adopted (US EPA, 1996).

Random sampling locations were determined using a procedure for generating random sampling locations based on recommendations in US EPA (2002). The procedure was:

a. A random number generator was used to generate two random numbers between 0 and 1.

b. The random numbers were converted into co-ordinates by multiplying them by the width and length of the site being investigated. Because the sampling area had an irregular shape, randomly generated points falling outside of the sample area were not used.

The above process was continued until the required number of sampling points had been generated. The sample location coordinates were then uploaded into a handheld Global Positioning System (GPS) unit which was used to locate each sampling position on the ground during the fieldwork.

Generation of random sampling points is different from sampling on a grid in that the points are not arranged in a systematic fashion and therefore there can be gaps in the pattern, giving the appearance that parts of the investigation area are not represented by samples. However, given there is no expectation that the waste is arranged in other than a random fashion, statistically, any location is as good as any other location on the landfill in developing a sampling scheme that gives an average result.

At each of the sample locations a surface sample was initially collected from the top 75mm of soil material, after first removing the grass. The surface samples represent soil that a person could be exposed to during normal use of the park. Deeper samples were also collected at each location from the top of the landfill material. This was achieved using a machine auger to penetrate the soil cover and expose the top of the waste, as identified by the recovery of such things as pieces of glass, metal or plastic.

A total of 24 sample locations were sampled. The 24 surface samples were then selected for combining into four composite samples by randomly selecting six samples from each of the six sub-areas in turn, repeating the process until all 24 samples were assigned to composites. The deeper samples were similarly assigned to composite samples, using the same scheme as for the surface samples.

All composite samples were prepared in the laboratory using equal-weight sub-samples from the dried samples, using the compositing scheme supplied by PDP.

Sample locations, sub-samples and composites are shown on Figure 5, with each composite being colour-coded (each sub-sample in a particular composite has the same colour).

4.3 BMX Track Area

The BMX track area sampling was carried out on a judgemental basis[3], targeting the points of lowest elevation around the track area. The lowest points are likely to have the least cover over the landfill material and therefore represent locations where the risk to track users from contaminants is potentially greatest. Surface samples were obtained from grassed areas to the side of these low points.

The samples were collected in the same manner as the upper and middle level surface samples, firstly removing the grass and then collecting soil material from the top 75mm of soil directly beneath this. Seven sub-samples were collected to make one composite sample (SS25 – SS31 Composite).

Deeper samples of waste were not collected from the BMX track as it was expected that the deeper samples from the upper and middle sections of the park would be representative of the waste under the BMX track. However, hand auger holes were advanced to ascertain depth to the top of the landfill material. A total of six hand auger holes were advanced in the low-points of the BMX area to establish depth to the top of the landfill material.

Sample locations, sub-samples and composites are on Figure 6.

4.4 Playground Area

The children's playground is located at the northern end of the park and accounts for only a small section of the greater park area. Playground area sampling has been carried out on a judgemental basis.

Six sub-samples were collected from the playground to make one composite sample (SS1 – SS6 Composite). The sub-samples were taken from close to each of the four items of play equipment, being locations where children are more likely to be exposed, and from two locations in between.

Sample locations, sub-samples and composites are shown on Figure 7.

In addition to the soil sampling, a hand auger was used to determine the depth to the top of the waste on four east-west transects spaced out across the area. A total of 12 holes were drilled. Depth to the top of the landfill was recorded in each hole, although landfill material was not encountered in the two northern-most hand auger locations.

[3] Judgemental sampling selects locations where contaminant concentrations are expected to be highest and/or exposure of park users is expected to be greatest for the particular sub-area.

4.5 Stormwater Trench Excavations – Recent and Historic

4.5.1 Recent Stormwater Trench and "Drum Excavation"

The recently excavated stormwater trench and "drum excavation" locations were excavated by Drainage Plus Contracting Limited for NPDC in May and June 2009. It is the latter area where drum remnants and chemical contamination were first identified, and subsequently removed with about 200 m^3 of soil. At the time of the investigation the trench had been backfilled but the area in the vicinity of the old and new manhole had only been partially reinstated, with a partially backfilled hole remaining. A pile of imported clean fill was beside the excavation to be used to complete reinstatement of the area (photographs 4 and 5).

Samples from the surface of the stormwater trench backfill were collected down the middle of the trench line (pointed out on site by Scott of Drainage Plus) at equally-spaced intervals. Six sub-samples were collected to make one composite sample (SS7 – SS12 Composite). The odd bit of broken glass and plastic, assumed to be from buried waste, was observed on the surface during the excavation.

Sampling in the "drum excavation" area was approached by random selection of sample locations in the area (outlined on-site by Phil of Drainage Plus). Two soil samples were collected from each of the six sample locations; one at the surface, and one at depth. The deeper samples were collected by advancing hand auger holes to 1m below ground level, or until refusal on hard material (e.g. gravels).

One composite sample consisting of six sub-samples was formed from the surface samples (SS13/1 – SS18/1 Composite), and one composite sample was formed from the six deeper sub-samples (SS13/2 – SS18/2 Composite).

Sample locations, sub-samples and composites are shown on Figure 7.

4.5.2 Historic Stormwater Trench

An historic trench is located to the east of the BMX track area. The object of this sampling was to determine whether excavation activities at the time of the trench excavation resulted in contaminated landfill material being left on the surface. The location of the trench was pointed out by Bryan Frank of the New Plymouth BMX Club.

Six samples were collected from the surface at equally-spaced intervals down the middle of the trench line. These make up one composite sample (SS19 – SS24 Composite).

Sample locations, sub-samples and composites are shown on Figure 6.

4.6 Equipment Decontamination and Sample Protection Procedures

Prior to the collection of each sample, intensive decontamination procedures were undertaken following the guidance of the "Timber Treatment Guidelines" (MfE/MoH,

1997) to minimise the risk of cross-contamination between samples. This is important given the low detection limit for the TCDD laboratory analysis.

These decontamination procedures used the “clean hands”/”dirty hands” approach as recommended in US EPA Method 1669 (USEPA, 1995). The procedures involved one field technician scrubbing the sample collection equipment of all remaining soil with Pyroneg® laboratory detergent and tap water, and rinsing with tap water; and the other field technician rinsing with acetone, wiping down with hexane-soaked glass-wool, rinsing with acetone, rinsing with analyte-free water and finally wrapping in pre-cleaned aluminium foil until use.

The acetone, hexane, analyte-free water and glass wool were prepared and supplied by AssureQuality. As part of their quality assurance procedures, AssureQuality tested these materials to be free of dioxins.

Disposable nitrile gloves were worn during the cleaning and sampling procedures, with gloves being changed for each individual decontamination process. All field technicians wore disposable nitrile gloves and disposable Tyvek® coveralls during the collection of samples. Gloves were changed for each sample collection point while the coveralls were changed daily or more often if required.

4.7 Sample Collection, Storage, and Transport

All samples were collected in laboratory-supplied containers. In the case of samples to be subjected to dioxin analysis, the containers had undergone a rigorous cleaning process by AssureQuality.

As each sample was collected, the containers were tightly sealed, labelled and stored in dedicated cool-boxes along with ice or freezer pads. At the completion of sample collection each day, glass jars were protected with bubble-wrap and the sealed containers couriered overnight with chain-of-custody documentation to the required laboratories for testing. It was requested that samples be put on “hold cold”’ until specific analyses could be specified.

4.7.1 QA/QC Samples

Each day, a rinsate blank sample was collected by rinsing one piece of field equipment using analyte-free water after the decontamination process had been completed, and collecting the rinsate in a sterile laboratory jar. These rinsate blanks were collected, stored and sent to the laboratory under the same chain-of-custody procedures and documentation as all other samples.

Rinsate blanks were placed on a ‘hold cold’ request pending receipt of the soil analysis results. The blanks would have been analysed if questionable results had been received, however, nothing was seen in the results to suggest cross-contamination or any other problem, and no analysis of rinsate blanks eventuated.

4.8 Health and Safety Procedures

During the investigation, health and safety measures for the protection of field technicians, contractors, and the public were implemented as per a site-specific Health and Safety Plan prepared by PDP.

Prior to any sub-surface sampling, the area was scanned by a specialist service location company (Detect Services Ltd of New Plymouth) to ensure no underground services were in the sample location.

Each sample location was barricaded off using cones, barriers, and vehicles to isolate the drill rig, contractor, and field technicians from members of the public. The safety barrier was moved with each new sampling position.

During the mechanical drilling down to the top of the landfill material, soil removed from each borehole was stored on a plastic groundsheet to minimise the impact of the drilling operations. The soil was returned to the hole on completion of sampling.

To guard against the possibility of landfill gas, continuous monitoring was conducted using a GA2000 Landfill gas meter, MiniRae Plus (for landfill gases) and a MiniRae 3000 (for volatile organic compounds). Work was to stop if short-term exposure limits (STEL) and/or workplace exposure limits (WEL) provided in the Health and Safety Plan were exceeded. In the event, no STEL or WEL was approached or exceeded. The highest readings noted for the landfill gas meter were identified at sample location C1/2 (in the Upper level of the park), where levels of ammonia reached 5 ppm (v/v) and levels of VOC reached 1.2 ppm. Values at these levels were noted again when obtaining samples from the 'drum excavation' area.

Chemicals used for decontamination procedures were decanted into squirt bottles and run-off was collected into dedicated buckets. At the completion of work each day, these chemicals were decanted into a glass bottle for disposal by the TRC laboratory, along with all other wastes from field consumables.

4.9 Laboratory Analysis

Composite samples were prepared in the laboratory. Each of the composite samples was subject to analysis for:

- TCDD screen, chlorophenols and a multi-residue pesticide screen to match the earlier analyses carried out by TRC;
- Semi-volatile organic compounds (SVOC) and a suite of total recoverable metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc) as these may be found in landfill material;

In addition, the surface and deep samples from the "drum excavation" were analysed for acid herbicides, including 2,4,5-T and 2,4-D.

It was a requirement that the organophosphate pesticide dichlofenthion and the 2,4,5-T raw material TCB be include in the analyses, as both of these compounds had been detected during the TRC sampling. Dichlofenthion is included in the multi-residue suite and TCB was added to the SVOC suite.

The analyses were specified to ensure the laboratories' quoted analytical detection limits were below (generally at least ten times below) the soil guideline values expected to be used to evaluate the laboratory results (see Section 6.2). In addition, given that an individual sub-sample in a composite can theoretically have a concentration equivalent to the reported composite concentration times the number of sub-samples in the composite, detection limits were checked to ensure that sixty times the detection limit (six being the expected number of sub-samples in each composite times a safety factor of 10 which is used to ensure the results are reliable) was below the relevant soil guideline values.

The TCDD screen and chlorophenol, SVOC and multi-residue analyses were carried out by Assure Quality in Lower Hutt. The acid herbicide and metals analyses were carried out by Hill Laboratories, Hamilton. Both of these laboratories are IANZ accredited for environmental analyses.

5.0 Investigation Results

5.1 General Observations

Landfill waste observed during investigation was completely decomposed with a soil-like appearance. Within the soil-like matrix bits of plastic, glass and other material resistant to decomposition confirmed the presence of waste. The overlying cover typically comprised of surface topsoil underlain by imported silty-clay fill material to the top of the landfill material.

A small amount of waste exists at the surface of the “drum excavation” and the new stormwater trench areas. This consists of plastics (bags, bottles, other litter), and some pieces of metal, concrete and wooden blocks. This suggests some mixing of the underlying fill with backfill material during the trench backfilling.

Landfill gas measurements during sampling in the upper and middle park levels found a general absence of landfill gas. This is consistent with decomposition of the waste being well advanced. Exceptions were location C1/2 in the Upper level of the park, where ammonia concentrations reached 5ppm and the “drum excavation” area where volatile organic compound (VOC) concentrations were recorded at 1.2ppm. Neither of these measurements is significant.

5.2 Depth of Cover Measurements

5.2.1 Upper and middle levels

Some depth to waste information was available from NPDC files from an investigation carried out in October 1994 on the upper two levels of the park. Soil borings in 12 locations on the top level and six locations on the middle level showed cover depths over the waste to be 0.4 – 0.95 m, with 0.6 – 0.8 m being typical (NZTCI, undated).

Depth to waste measurements during this investigation found similar soil cover thickness (Figure 2), typically ranging from 0.6 to 1.1 m. The least cover was 0.35 m in a single location in the southwest of the upper level.

5.2.2 Playground

The depth to landfill material for the playground area is shown on Figure 4.

In general, the depth of cover is in excess of 0.75 m and typically closer to 1 m. No waste was encountered in the two northern-most investigation holes. This is consistent with reports that the waste did not extend as far north as the park accessway in the stormwater pipe trench (Victoria McKay, NPDC, pers.comm). However, as obstructions were encountered in the northern-most auger holes, preventing further drilling, the northern extent of the waste has not been definitively determined.

The waste is shallower in the vicinity of the tree by the "drum excavation"; around 0.3 – 0.45 m. This is consistent with TRC photographs taken at the time of the drum excavation in May 2009. There are insufficient auger holes to exactly determine where the cover thins out between the playground and the “drum excavation”.

Following reinstatement of the “drum excavation” cover over the waste is expected to be at least 500 mm.

1.1.1 BMX Track

Depth to waste under the lowest parts of the BMX track had been reported to be as little as 0.2 – 0.25 m (Bryan Frank, pers comm.), however cover this thin was not found during the investigation. The least cover encountered was 0.45m (Figure 3), with cover more typically at least 0.9 m. The sub-grade for the BMX track has been excavated below the surrounding ground to provide for the thickness of the crushed limestone track. Thus the reported cover under the lowest parts of the track and the minimum depth found during this investigation is not necessarily inconsistent if a track depth of 200 – 300 mm is allowed for.

Much of the track area is built up relative to the original surface using imported soil to create the track humps and grassed areas between and surrounding the track (Photograph 3). In these areas the depth of cover is expected to be well in excess of 1 m.

5.3 Laboratory Results

5.3.1 General

The full laboratory reports are provided in the laboratory reports in Appendix D. Many of the results were below the respective analytical detection limits. Results for compounds of particular interest, and/or where concentrations were above the analytical detection limits have been summarised in tables 1 to 6 (Appendix C) against the various sample locations.

For the composite samples for the upper and middle levels of the park, the tabulations present the results as pairs of surface and deeper samples. Composites consisting of sub-samples with the suffix ‘/1’ are the surface samples while the deeper composites have sub-samples with the suffix ‘/2’.

5.3.2 Metals

Metal results are presented in Table 1. There is a general consistency within the results for each metal, with most results appearing to be typical of background concentrations. Even some of the samples collected from the surface of the landfill waste appear to be typical of background concentrations. The exceptions are deeper composites (A3/2+B4/2+C2/2+D3/2+E2/2+F6/2), (A1/2+B3/2+C6/2+D1/2+E4/2+ F5/2) and

(A6/2+B2/2+C4/2+D2/2+E5/2+F8/2) which show some elevation in one or more of lead, copper and zinc. This is not surprising as lead copper and zinc are typically elevated in landfill material, although the concentrations reported are lower than has been observed by PDP in other landfill samples. The highest concentrations were lead at 200 mg/kg and zinc at 250 mg/kg. Lead at a few hundred to a few thousand mg/kg is not unusual in old landfill material.

5.3.3 Chlorophenols

The chlorophenol analysis results are presented in Table 2, and include results for three trichlorophenol isomers. Trichlorophenol is a precursor substance for 2,4,5-T production and, in technical grade trichlorophenol, the source of dioxin contamination in 2,4,5-T.

No chlorophenols were detected in any of the samples at detection limits of 0.005 to 0.1 mg/kg.

5.3.4 TCDD Screen

The TCDD screen results are presented in Table 3. The TCDD screen consists of analysis for 2,3,7,8-TCDD and 2,3,7,8-TCDF, two of the 17 dioxin and furan congeners thought to pose a risk to human and environmental health. Dioxin contamination of TCP and 2,4,5-T is dominated by TCDF and TCDF when the potency of the various congeners is taken into account.

All but one of the soil composites had detectable TCDD and/or TCDF at concentrations generally in the range of a few to fractions of a ng/kg, with the highest concentration of 39 ng/kg[4] found in surface soil along the line of the stormwater trench. The next highest sample was less than a tenth of that from below the surface in the “drum excavation”.

Results from the main park are quite consistent, with the surface samples typically being 0.2 – 0.3 ng/kg and samples from the surface of the waste being about five to eight times higher.

The TCDD screen represents only some of the many dioxins typically present. However, analysis of soil sampling results from Paritutu (PDP, 2002) shows that the TCDD screen accounts for 70 – 90% of the TCDD Toxic Equivalence[5] (TEQ) derived from probable TCP and 2,4,5-T sources. It is not possible to determine whether the particular samples are dominated by TCDD without doing a full congener profile. However, even if the detected dioxin represents some other Dixon source, e.g. a combustion source, it is expected that the TCDD screen would represent at least 25% of the TEQ (based on calculations using

[4] A ng/kg is the same as pg/g reported in the laboratory reports. One ng/kg = one part per trillion by weight (ppt), or a millionth of one mg/kg.

[5] A method of representing the toxicity of the dioxin congener mixture relative to 2,3,7,8-TCDD.

typical dioxin profiles from combustion sources). This means that, at worst, the sample results should be multiplied by four to estimate the TEQ.

5.3.5 Pesticide Screen

The pesticide screen results for detected compounds are presented in Table 4. Most of the 248 compounds analysed for were not detected at method detection limits ranging from 0.01 to 0.1 mg/kg. Five of the 14 composites detected one or more pesticides at concentrations close to the detection limits. Compounds detected included the organochlorine insecticides DDT and dieldrin, the triazine herbicides simazine, ametryn and simetryn and the organophosphate insecticide dichlofenthion. The composite sample with the most pesticides detected was from a deeper composite from the upper and middle levels of the park. The dichlofenthion was detected in the composite from the stormwater trench surface.

5.3.6 SVOC and Tetrachlorobenzene analyses

The complete SVOC analyses have not been tabulated as they are either duplicates of other analyses or the results were non-detects. Six of the 14 composites had detectable PAHs and these are summarised in Table 5. The tetrachlorobenzene results have not been tabulated, as all results were non-detects. Tetrachlorobenzene is a precursor substance for manufacturing 2,4,5-T.

The PAH results have been presented as individual PAHs, the sum of the 16 PAHs commonly analysed and the benzo(a)pyrene equivalent concentration (BaP_{eq}) calculated from the seven carcinogenic PAHs.

The detected PAHs were, with one exception, in deeper composites, and probably associated with landfill waste. PAHs are a common contaminant in landfill waste. Concentrations of individual PAHs were typically less than 1 mg/kg with the BaP_{eq} concentration in the range 0.3 – 1.1 mg/kg.

5.3.7 Acid Herbicides

The acid herbicide results for the four playground and “drum excavation” samples are presented in Table 6. All results were non-detects at a detection limit of <0.2 mg/kg.

6.0 Environmental Assessment

6.1 Receptors and Pathways

A risk to human health or the environment can only arise if there is a hazard (e.g. contaminated soil), a receptor (people or the environment) and an exposure pathway linking the hazard and receptor. An absence of any of these components means no risk can exist.

For Marfell Park, the receptors of concern are people, in particular young children. The main exposure pathway is soil ingestion. All of us ingest small amounts of soil as part of our day-to-day activities, typically through hand to mouth contact with dirty hands. Children ingest more soil than adults because children generally have more hand to mouth contact than adults. In addition, for some chemicals, particularly organic compounds such as some pesticides, a second pathway is dermal absorption. Small amounts of the contaminant can be absorbed through the skin if contaminated soil comes into contact with the skin for prolonged periods of time.

The combination of more soil ingested, generally getting dirtier and lower body weight makes children more vulnerable to exposure to contaminated soil than adults.

Occasional or limited exposure to even relatively high concentrations of contaminants typically presents no particular risk. This would be the situation for a person walking across the grassed areas of Marfell Park. Conversely, contaminants in a residential property present a much higher risk, and therefore much lower concentrations can be tolerated, as residents are typically exposed every day, may have direct contact through bare soil in gardens and may also grow vegetables in contaminated soil. A playground presents a risk intermediate between these two scenarios, with perhaps up to daily exposure for short periods of time, but little if any contact with bare soil unless conditions are wet and muddy.

To help determine whether the concentrations of contaminants detected during the investigation represent a significant risk to people, laboratory results are compared against various published soil guideline values as a “screening exercise”. Where site concentrations are below relevant guideline criteria, it can be concluded that no significant risk exists on the site, for the particular pathway(s) and receptor(s).

The soil guideline values are intended to be applied to surface soil and are therefore not strictly applicable to samples collected from below the surface, for example the deeper samples from the main park areas and in the “drum excavation”. This is because there is no or only a limited exposure pathway between the deeper soil and a person on the surface, therefore very much higher soil concentrations can be tolerated in deeper soil than at the surface. However, as a conservative first “screening”, soil guideline values intended for surface soil may be applied to deeper samples. In addition, comparison with surface soil guidelines gives a measure of the risk if the deeper soil were to be brought to the surface in future, where exposure could then occur.

6.2 Soil Guideline Values Used

Soil guideline values are derived for a small set of generic land use scenarios, typically residential, industrial and, sometimes, for recreational use. New Zealand has only a small number of generic guidelines for the most common contaminants encountered and/or some of the New Zealand values are out of date and should not be used. In the absence of New Zealand-derived guidelines, which is the case for many of the contaminants analysed for in this investigation, it is normal to use similarly calculated values from overseas. This is in accordance with the recommendations of MfE's Contaminated Land Management Guideline No. 2 (MfE, 2003).

New Zealand has suitable guidelines for a small number of contaminants in the so-called Timber Treatment Guidelines (MfE/MoH, 1997, The Gasworks Guidelines (MfE, 1997) and the Sheep-dip Guidelines (MfE, 2006). Otherwise, the United States Environmental Protection Agency's Regional Soil Screening Levels (US EPA, 2009) provide values for a wide range of contaminants. These guidelines are derived similarly to New Zealand guidelines, although somewhat more conservatively.

New Zealand has generic guidelines for recreational (parkland) use for only a very small number of contaminants and the United States not at all. Where New Zealand recreational guidelines exist these have been used. This is the case for PAHs.

In the absence of recreational guidelines the closest generic scenario is the residential scenario. This is more conservative than recreational exposure but provides an initial conservative screening. If the sampling results comply with residential soil guideline values then it can be safely concluded that the results would also comply with recreational use guidelines if they existed. If a laboratory result does not comply with a residential guideline then the next step is to derive a recreational guideline for the particular contaminant using the soil guideline derivation procedures recently developed for MfE (Proffitt *et al*, 2008). However, this proved to be unnecessary.

A complicating factor with New Zealand residential guidelines is that they include consideration of contaminant exposure through consumption of home-grown vegetables. This is clearly not appropriate for a park scenario. The New Zealand residential guidelines contained in MfE/MoH (1997) and MfE (2006) have therefore been recalculated leaving out the home-grown vegetable component. The US EPA (2009) guidelines do not consider home-grown produce and no adjustment is necessary.

Both the New Zealand and United States guidelines assume the critical receptor is a 15 kg child. This is the equivalent of about a two-year old child. The guidelines derived for a small child are protective of older children and adults.

A special case exists for dioxin. The existing New Zealand residential guideline in MfE/MoH (1997) is out of date because in 2002 the Ministry of Health adopted a maximum monthly intake value somewhat lower than previously used to derive the dioxin guideline (MoH, 2002). The US EPA soil guideline value is also not appropriate because its toxicological basis is different from the MoH recommendation. Accordingly, a site-

specific guideline for TCDD has been derived using the MoH (2002) intake recommendation of 30 pg/kg bw/month[6] and exposure parameters relevant to recreational use. This has been based on exposure parameters from the new draft MfE derivation methodology (Proffitt et al, 2008), and other parameters proposed by Cavanagh in draft advice to MfE (Cavanagh, in prep). The derived recreational guideline value is 1100 ng/kg.

The various soil guideline values used in this study are listed in the right hand-most column in the tabulated results of tables 1 to 6.

6.3 The Playground and "Drum Excavation"

All the playground and "drum excavation" composite samples complied with soil guideline values for all contaminants, where guidelines exist, generally by large factors. Even if all the contaminant existed in a single sample within a composite (i.e. after multiplying the result by the number of sub-samples within the composite, typically six) the factored results comfortably comply with guideline values.

With respect to dioxins, the sample with the highest TEQ value is from the surface of the stormwater trench, at 39 ng TEQ/kg. If its is assumed that the TCDD represents only a quarter of the TEQ (see previous discussion) and all the detected TCDD is in a single sub-sample, then an individual sub-sample might have as much as 940 ng/kg TEQ. This is less than the guideline value of 1100 ng/kg, and therefore the sample location does not present an unacceptable risk. In reality it is average concentrations that are important, as people are exposed to a variety of locations as they move from place to place, and the guideline is comfortably complied with.

Some of the pesticides do not have guidelines. This is generally because the pesticides are obsolete, little used or are insufficiently toxic to be of great concern. As noted in PDP (2009) dichlofenthion, a compound that attracted the interest of some residents, does not have a guideline. However, based on its toxicity, the detected concentrations (0.21 mg/kg) are not of concern. The low concentrations of other pesticides detected are also not of concern.

Overall, the sampling results indicate minimal risk from contaminants in the surface soils. In addition, cover to the underlying waste is generally adequate to prevent exposure to the waste. However, additional cover is recommended in the vicinity of the "drum excavation". At least 500 mm and preferably 1 m of cover is recommended in this area.

Future excavations in the area should avoid penetrating the surface cover. If this cannot be avoided, care should be taken during excavation so that waste is not spread on the surface during the work. It is preferable that trenches excavated in the old landfill material be backfilled with clean material and the waste disposed of appropriately.

[6] pg = picogram, or a millionth of a millionth of a gram

6.4 The BMX Track

The single BMX track composite sample complied with all guideline values, as did the composite sample from the historic trench beside the BMX track. The sample results indicate the surface soil presents minimal risk to track users.

The investigations suggest cover to the underlying waste is adequate over most of the track area. However, the waste is reported to be at shallow depth under the lowest parts of the track. This presents no particular risk while the track remains in place. However, care should be taken during track maintenance or redevelopment work to avoid excavating into the waste. Any waste that has to be excavated should be reburied under at least 500 mm of cover or disposed of to landfill. Waste material should not be left lying on the surface.

It is recommended that a management plan be developed in conjunction with the District Council to control future excavation works at the track.

6.5 Middle and Upper Park Levels

The composite sampling results values for the middle and upper levels of the park complied with all soil guideline values. Minimal risk is indicated for park users. In addition, the sample results for the surface of the landfill material suggest little risk to park users should this material be brought to the surface. However, it is prudent to avoid bringing waste to the surface, as contaminant concentrations are likely to be variable. Hotspots probably exist in excess of the measured concentrations.

The depth of cover over the landfill material is adequate in most locations. While additional cover is desirable in the single location where cover was found to be as little as 0.35 m (and other similar locations probably exist), the additional risk from this reduced cover is not so great that remedial work is required. The middle and upper levels of the park are suitable for their current use.

7.0 Conclusions and Recommendations

Sampling of surface and deeper soil was carried out at various locations in Marfell Park, including the little used areas of the middle and upper levels of the main park and the more intensively used BMX track and children's playground.

Analysis of the soil samples found only low concentrations of a wide range of organic contaminants and a suite of eight metals. Concentrations of contaminants within landfill material were at the lower end of typical landfill material. There was generally little evidence of anthropogenic contamination of surface soil in most locations sampled.

A few samples had low concentrations of some pesticides, but there was a general absence of compounds historically used to manufacture the herbicide 2,4,5-T.

The TCDD dioxin screen similarly returned low concentrations. The composite sample with the highest dioxin concentrations was taken from the surface of the backfill in the new stormwater trench running through the playground. The result may reflect some effects from the residues discovered during the trench excavation; however the risk to park users is minimal at the detected concentration. The peak dioxin result was below the relevant guideline.

Cover over the historic landfill material was found to be adequate in most locations. An exception was in the vicinity of the "drum excavation", where additional cover is recommended.

While contaminant concentrations in the underlying waste were found to generally comply with soil guideline values, indicating minimal risk even if the material was brought to the surface, it is expected that the waste is variable from place to place. Contaminant hotpots can be expected. Accordingly, it is recommended that excavation into the waste is avoided.

If excavation into the waste cannot be avoided, then care should be taken to minimising spreading of waste on the surface or mixing with clean soil. Waste should be reburied under an adequate cover layer of clean soil, or, preferably, disposed of to a landfill or other licensed facility.

It is recommended that a management plan be developed to control excavation and guard against inappropriate soil disposal.

Overall, the park is suitable for its current use.

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Appendix A Figures

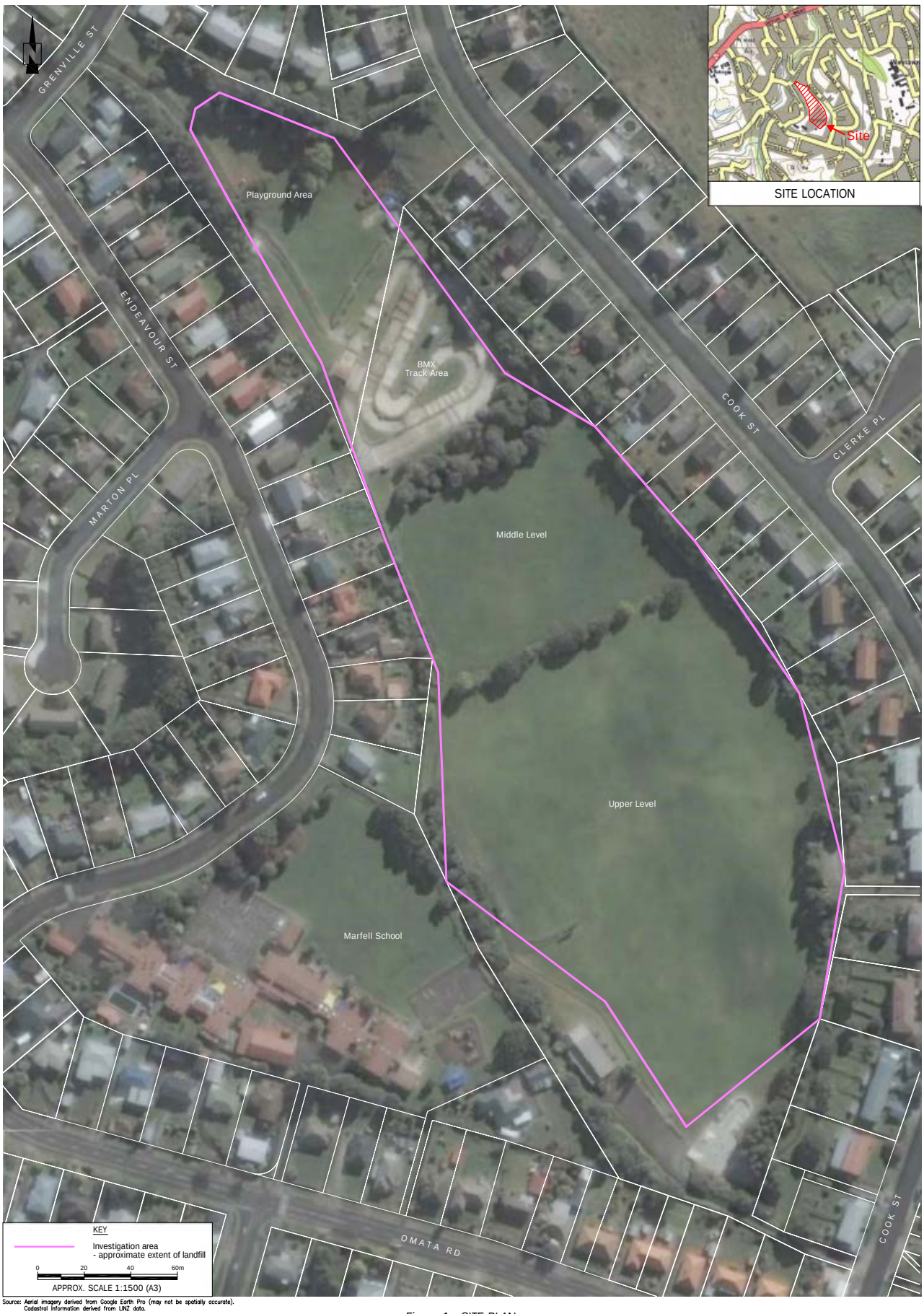

Figure 1 : SITE PLAN

MARFELL PARK ENVIRONMENTAL INVESTIGATION – TARANAKI REGIONAL COUNCIL

Figure 2 : DEPTH OF COVER (UPPER & MIDDLE LEVELS)

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MARFELL PARK ENVIRONMENTAL INVESTIGATION – TARANAKI REGIONAL COUNCIL

Source: Aerial imagery derived from Google Earth Pro (may not be spatially accurate).
Cadastral information derived from LINZ data.

Figure 3 : DEPTH OF COVER (BMX TRACK AREA)

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MARFELL PARK ENVIRONMENTAL INVESTIGATION – TARANAKI REGIONAL COUNCIL

Source: Aerial imagery derived from Google Earth Pro (may not be spatially accurate).
Cadastral information derived from LINZ data.

Figure 4 : DEPTH OF COVER (PLAYGROUND AREA)

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Figure 5 : SAMPLE LOCATIONS (UPPER & MIDDLE LEVELS)

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MARFELL PARK ENVIRONMENTAL INVESTIGATION – TARANAKI REGIONAL COUNCIL

Figure 6 : SAMPLE LOCATIONS AND PARTIAL RESULTS (BMX TRACK AREA)

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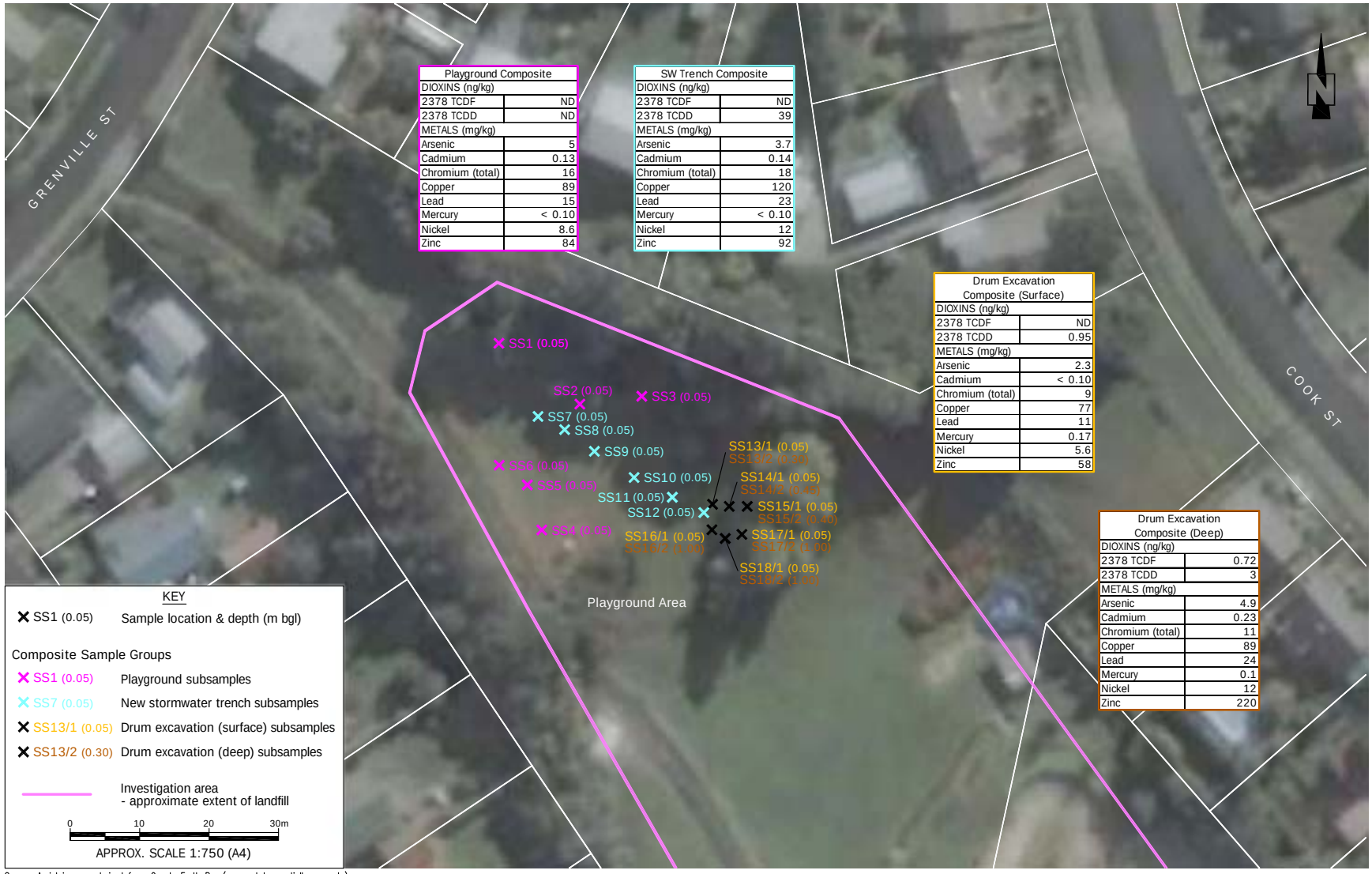
MARFELL PARK ENVIRONMENTAL INVESTIGATION – TARANAKI REGIONAL COUNCIL



Playground Composite	
DIOXINS (ng/kg)	
2378 TCDF	ND
2378 TCDD	ND
METALS (mg/kg)	
Arsenic	5
Cadmium	0.13
Chromium (total)	16
Copper	89
Lead	15
Mercury	< 0.10
Nickel	8.6
Zinc	84

SW Trench Composite	
DIOXINS (ng/kg)	
2378 TCDF	ND
2378 TCDD	39
METALS (mg/kg)	
Arsenic	3.7
Cadmium	0.14
Chromium (total)	18
Copper	120
Lead	23
Mercury	< 0.10
Nickel	12
Zinc	92

Drum Excavation Composite (Surface)	
DIOXINS (ng/kg)	
2378 TCDF	ND
2378 TCDD	0.95
METALS (mg/kg)	
Arsenic	2.3
Cadmium	< 0.10
Chromium (total)	9
Copper	77
Lead	11
Mercury	0.17
Nickel	5.6
Zinc	58

Drum Excavation Composite (Deep)	
DIOXINS (ng/kg)	
2378 TCDF	0.72
2378 TCDD	3
METALS (mg/kg)	
Arsenic	4.9
Cadmium	0.23
Chromium (total)	11
Copper	89
Lead	24
Mercury	0.1
Nickel	12
Zinc	220

KEY

SS1 (0.05) Sample location & depth (m bgl)

Composite Sample Groups

SS1 (0.05) Playground subsamples

SS7 (0.05) New stormwater trench subsamples

SS13/1 (0.05) Drum excavation (surface) subsamples

SS13/2 (0.30) Drum excavation (deep) subsamples

Investigation area
- approximate extent of landfill

0 10 20 30m

APPROX. SCALE 1:750 (A4)

Source: Aerial imagery derived from Google Earth Pro (may not be spatially accurate).
Cadastral Information derived from LINZ data.

Figure 7 : SAMPLE LOCATIONS & PARTIAL RESULTS (PLAYGROUND AREA)

W01772101D001.dwg [W01772101001.jpg] Aug-09

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Appendix B Photographs

Photograph 1: Marfell Park upper level looking southeast. Scatepark is in the right distance

Photograph 2: Marfell Park middle level looking south and southwest. Slightly higher land to left is unfilled natural ground

Photograph 3: Marfell Park lower level – BMX track looking west and north

Photograph 4: Marfell Park lower level looking north towards playground in middle distance with excavation area in foreground. Drum remnants were found between tree and manhole.

Photograph 5: Looking up stormwater trench through playground to “drum excavation”

Photograph 6: Playground equipment. Stormwater trench in foreground

Appendix C Results Tables

Table 1: Soil Sample Results – Total Recoverable Metals (mg/kg)

Sample Name	Playground Composite	SW Trench Composite	Drum Excavation Composite (Surface)	Drum Excavation Composite (Deep)	Historic SW Trench Composite	BMX Track Composite	A3/1 + B4/1 C2/1 + D3/1 E2/1 + F6/1 (Composite)	A3/2 + B4/2 C2/2 + D3/2 E2/2 + F6/2 (Composite)	A11/1 + B5/1 C1/1 + D6/1 E3/1 + F3/1 (Composite)	A11/2 + B5/2 C1/2 + D6/2 E3/2 + F3/2 (Composite)	A1/1 + B3/1 C6/1 + D1/1 E4/1 + F5/1 (Composite)	A1/2 + B3/2 C6/2 + D1/2 E4/2 + F5/2 (Composite)	A6/1 + B2/1 C4/1 + D2/1 E5/1 + F8/1 (Composite)	A6/2 + B2/2 C4/2 + D2/2 E5/2 + F8/2 (Composite)	**Residential Soil Guidelines**
Laboratory Reference	709708.9	709709	709709	709709	709709	709708.9	709708.91	709709	709708.92	709709	709708.93	709708.97	709708.9	709709	
Date	15 July, 2009				16 July, 2009		13 & 14 July, 2009								
Sample Location	Playground	SW Trench	Drum Excavation		Historic SW Trench	BMX Track	Upper and Middle Levels								
Sub-sample Depth (m bgl)[1]	0 - 0.075	0 - 0.075	0 - 0.075	0.35 - 1.0	0 - 0.075	0 - 0.075	0 - 0.075	0.35 - 0.90	0 - 0.075	0.70 - 1.00	0 - 0.075	0.60 - 0.95	0 - 0.075	0.80 - 1.10	
Arsenic	5.0	3.7	2.3	4.9	2.5	3.1	3.1	4.8	2.8	3.5	3.0	3.4	2.9	3.1	95[2]
Cadmium	0.13	0.14	< 0.10	0.23	0.41	0.16	0.3	0.28	0.25	0.12	0.31	0.27	0.39	0.19	70[3]
Chromium (total)	16	18	9.0	11	6.3	16	13	24	12	18	11	15	12	18	115,000[2,4]
Copper	89	120	77	89	42	81	87	99	78	98	78	95	85	110	7,800[2]
Lead	15	23	11	24	7.9	16	15	200	18	43	15	45	18	23	400[3]
Mercury	< 0.10	< 0.10	0.17	0.1	< 0.10	< 0.10	< 0.10	0.7	0.25	0.15	0.13	0.11	0.12	< 0.10	23[3]
Nickel	8.6	12	5.6	12	7.8	11	7.5	12	6.6	11	6.7	7.6	7.5	13	1,500[3]
Zinc	84	92	58	220	52	85	68	190	69	90	62	250	84	110	23,000[3]

Notes:

1. Deeper samples were taken over a range of depths depending on when waste was first encountered in the particular hole
2. Criteria from the *Health and Environmental Guidelines for Selected Timber Treatment Chemicals* recalculated to exclude the produce consumption pathway (MfE/MoH, 1997)
3. Criteria from the USEPA Regional Screening Levels (USEPA, 2009)
4. Value for Chromium III

Table 2: Soil Sample Results - Chlorophenols (mg/kg)

Sample Name	Playground Composite	SW Trench Composite	Drum Excavation Composite (Surface)	Drum Excavation Composite (Deep)	Historic SW Trench Composite	BMX Track Composite	A3/1 + B4/1 C2/1 + D3/1 E2/1 + F6/1 (Composite)	A3/2 + B4/2 C2/2 + D3/2 E2/2 + F6/2 (Composite)	A11/1 + B5/1 C1/1 + D6/1 E3/1 + F3/1 (Composite)	A11/2 + B5/2 C1/2 + D6/2 E3/2 + F3/2 (Composite)	A1/1 + B3/1 C6/1 + D1/1 E4/1 + F5/1 (Composite)	A1/2 + B3/2 C6/2 + D1/2 E4/2 + F5/2 (Composite)	A6/1 + B2/1 C4/1 + D2/1 E5/1 + F8/1 (Composite)	A6/2 + B2/2 C4/2 + D2/2 E5/2 + F8/2 (Composite)	Laboratory Blank	**Residential Guideline Values [1]**
Laboratory Reference	58715-9	58715-10	58715-11	58715-14	58715-12	58715-13	58715-1	58715-5	58715-2	58715-6	58715-3	58715-7	58715-4	58715-8	57815-Blank	
Date	15 July, 2009				16 July, 2009		13 & 14 July, 2009								-	
Sample Location	Playground	SW Trench	Drum Excavation		Historic SW Trench	BMX Track	Upper and Middle Levels								-	
Sub-sample Depth (m bgl)[2]	0 - 0.075	0 - 0.075	0 - 0.075	0.35 - 1.0	0 - 0.075	0 - 0.075	0 - 0.075	0.35 - 0.90	0 - 0.075	0.70 - 1.0	0 - 0.075	0.60 - 0.95	0 - 0.075	0.80 - 1.10	-	
Phenol	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	18,000
2-Chlorophenol	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	390
2,6-Dichlorophenol	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-
2,4-Dichlorophenol	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	180
2,4,6-Trichlorophenol	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	440 [3]
2,4,5-Trichlorophenol	< 0.05	0.48	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	6,100
3,4,5-Trichlorophenol	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-
2,3,4,6-Tetrachlorophenol	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	1,800
Pentachlorophenol	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	30 [3]

Note:

1. Criteria from the US EPA Regional Screening Levels (US EPA, 2009)
2. Deeper samples were taken over a range of depths depending on when waste was first encountered in the particular hole
3. Values for carcinogens from US EPA (2009) have been multiplied by 10 due to the carcinogenic risk factor used in New Zealand being 1 in 100,000 compared with 1 in 1,000,000 in the United States

Table 3: Soil Sample Results – TCDD Screen (ng/kg)

Sample Name	Playground Composite	SW Trench Composite	Drum Excavation Composite (Surface)	Drum Excavation Composite (Deep)	Historic SW Trench Composite	BMX Track Composite	A3/1 + B4/1 C2/1 + D3/1 E2/1 + F6/1 (Composite)	A3/2 + B4/2 C2/2 + D3/2 E2/2 + F6/2 (Composite)	A11/1 + B5/1 C1/1 + D6/1 E3/1 + F3/1 (Composite)	A11/2 + B5/2 C1/2 + D6/2 E3/2 + F3/2 (Composite)	A1/1 + B3/1 C6/1 + D1/1 E4/1 + F5/1 (Composite)	A1/2 + B3/2 C6/2 + D1/2 E4/2 + F5/2 (Composite)	A6/1 + B2/1 C4/1 + D2/1 E5/1 + F8/1 (Composite)	A6/2 + B2/2 C4/2 + D2/2 E5/2 + F8/2 (Composite)	Laboratory Blank	**Site-Specific Parkland Guideline Value** [1]
Laboratory Reference	58715-9	58715-10	58715-11	58715-14	58715-12	58715-13	58715-1	58715-5	58715-2	58715-6	58715-3	58715-7	58715-4	58715-8	57815-Blank	
Date	15 July, 2009				16 July, 2009		13 & 14 July, 2009								-	
Sample Location	Playground	SW Trench	Drum Excavation		Historic SW Trench	BMX Track	Upper and Middle Levels								-	
Sub-sample Depth (m bgl)[2]	0 - 0.075	0 - 0.075	0 - 0.075	0.35 - 1.0	0 - 0.075	0 - 0.075	0 - 0.075	0.35 - 0.90	0 - 0.075	0.70 - 1.0	0 - 0.075	0.60 - 0.95	0 - 0.075	0.80 - 1.10	-	
2378 TCDF	ND[3]	ND	ND	0.72	ND	ND	ND	0.37	0.32	0.59	0.36	0.36	0.34	0.68	ND	-
2378 TCDD	ND	39	0.95	3.0	0.37	0.45	0.23	1.4	0.27	1.7	0.31	1.5	0.23	2.3	ND	-
WHO (2005) TEQ [4]	ND	39	0.95	3.1	0.37	0.45	0.23	1.4	0.30	1.8	0.35	1.5	0.26	2.4	ND	1100

Note:

1. Derived following the method of Proffitt *et al.* (2008) using an Interim Monthly Maximum Intake of 30 pg/kg bw (MoH, 2002) and background intake and dermal absorption factor from Cavanagh (in prep).
2. Deeper samples were taken over a range of depths depending on when waste was first encountered in the particular hole
3. ND = non-dectect
4. TCDD Toxic Equivalence calculated using the Toxic Equivalency Factors from Van den Berg *et al.* (2006)

Table 4: Soil Sample Results - Pesticides (mg/kg)

Sample Name	Playground Composite	SW Trench Composite	Drum Excavation Composite (Surface)	Drum Excavation Composite (Deep)	Historic SW Trench Composite	BMX Track Composite	A3/1 + B4/1 C2/1 + D3/1 E2/1 + F6/1 (Composite)	A3/2 + B4/2 C2/2 + D3/2 E2/2 + F6/2 (Composite)	A11/1 + B5/1 C1/1 + D6/1 E3/1 + F3/1 (Composite)	A11/2 + B5/2 C1/2 + D6/2 E3/2 + F3/2 (Composite)	A1/1 + B3/1 C6/1 + D1/1 E4/1 + F5/1 (Composite)	A1/2 + B3/2 C6/2 + D1/2 E4/2 + F5/2 (Composite)	A6/1 + B2/1 C4/1 + D2/1 E5/1 + F8/1 (Composite)	A6/2 + B2/2 C4/2 + D2/2 E5/2 + F8/2 (Composite)	**Residential Guideline Values**
Laboratory Reference	58715-9	58715-10	58715-11	58715-14	58715-12	58715-13	58715-1	58715-5	58715-2	58715-6	58715-3	58715-7	58715-4	58715-8	
Date	15 July, 2009				16 July, 2009		13 & 14 July, 2009								
Sample Location	Playground	SW Trench	Drum Excavation		Historic SW Trench	BMX Track	Upper and Middle Levels								
Sub-sample Depth (m bgl)[1]	0 - 0.075	0 - 0.075	0 - 0.075	0.35 - 1.0	0 - 0.075	0 - 0.075	0 - 0.075	0.35 - 0.90	0 - 0.075	0.70 - 1.0	0 - 0.075	0.60 - 0.95	0 - 0.075	0.80 - 1.10	
Total DDT [2]	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	0.042	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	70 [3]
Dichlofenthion	-	0.21	-	-	-	-	-	-	-	-	-	-	-	-	- [4]
Dieldrin	-	-	-	0.094	-	-	-	-	-	-	-	-	-	-	12 [3]
Diphenylamine	-	-	-	-	-	-	-	0.018	-	0.061	-	-	-	-	1,500 [5]
Piperonyl Butoxide	-	-	-	-	-	-	-	0.012	-	-	-	-	-	-	- [4]
Simazine	-	0.055	-	-	-	-	-	0.040	-	-	-	-	-	-	40 [5,6]
Ametryn	-	-	-	-	-	-	-	0.028	-	0.024	-	0.014	-	-	550 [5]
Simetryn	-	-	-	-	-	-	-	0.047	-	-	-	-	-	-	- [4]

Notes:

1. Deeper samples were taken over a range of depths depending on when waste was first encountered in the particular hole
2. Total DDT includes the sum of DDD, DDE, and DDT. If the concentration of these parameters is below the laboratory levels of detection, a value of half of the detection limit is used
3. Criteria from *Identifying, Investigating, and Managing Risks Associated with Former Sheep-Dip Sites: A Guide for Local Authorities*, MfE (2006).
4. No guideline value available
5. Criteria from the US EPA Regional Screening Levels (US EPA, 2009)
6. Values for carcinogens from US EPA (2009) have been multiplied by 10 due to the carcinogenic risk factor used in New Zealand being 1 in 100,000 compared with 1 in 1,000,000 in the United States

Table 5: Soil Sample Results – Polycyclic Aromatic Hydrocarbons (mg/kg)

Sample Name		Playground Composite	SW Trench Composite	Drum Excavation Composite (Surface)	Drum Excavation Composite (Deep)	Historic SW Trench Composite	BMX Track Composite	A3/1 + B4/1 C2/1 + D3/1 E2/1 + F6/1 (Composite)	A3/2 + B4/2 C2/2 + D3/2 E2/2 + F6/2 (Composite)	A11/1 + B5/1 C1/1 + D6/1 E3/1 + F3/1 (Composite)	A11/2 + B5/2 C1/2 + D6/2 E3/2 + F3/2 (Composite)	A1/1 + B3/1 C6/1 + D1/1 E4/1 + F5/1 (Composite)	A1/2 + B3/2 C6/2 + D1/2 E4/2 + F5/2 (Composite)	A6/1 + B2/1 C4/1 + D2/1 E5/1 + F8/1 (Composite)	A6/2 + B2/2 C4/2 + D2/2 E5/2 + F8/2 (Composite)	**Parklands Soil Guidelines [1]**
Laboratory Reference		709708.9	709709	709709	709709	709709	709708.9	709708.91	709709	709708.92	709709	709708.93	709708.97	709708.9	709709	
Sample Location		Playground	SW Trench	Drum Excavation		Historic SW Trench	BMX Track	Upper and Middle Levels								
Sub-sample Depth (m bgl)[1]		0.05	0.05	0.05	0.35 - 1.0	0.05	0.05	0.05	0.35 - 0.90	0.05	0.70 - 1.00	0.05	0.60 - 0.95	0.05	0.80 - 1.10	
Analyte	BaP TEF [3]															
Acenaphthene		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	36,000
Acenaphthylene		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	18,000
Anthracene		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.18	< 0.1	0.23	< 0.1	0.32	< 0.1	0.31	180,000
Benzo[a]anthracene	0.1	< 0.1	< 0.1	< 0.1	0.12	< 0.1	< 0.1	< 0.1	0.35	0.15	0.68	< 0.1	0.52	< 0.1	0.83	-
Benzo[a]pyrene (BaP)	1	< 0.1	< 0.1	< 0.1	0.15	< 0.1	< 0.1	< 0.1	0.34	0.14	0.85	< 0.1	0.53	< 0.1	0.77	-
Benzo[b]fluoranthene	0.1	< 0.1	< 0.1	< 0.1	0.12	< 0.1	< 0.1	< 0.1	0.28	0.11	0.61	< 0.1	0.45	< 0.1	0.62	-
Benzo[g,h,i]perylene		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.21	< 0.2	0.56	< 0.2	0.3	< 0.2	0.46	-
Benzo[k]fluoranthene	0.01	< 0.1	< 0.1	< 0.1	0.14	< 0.1	< 0.1	< 0.1	0.28	0.11	0.6	< 0.1	0.4	< 0.1	0.65	-
Chrysene	0.001	< 0.1	< 0.1	< 0.1	0.14	< 0.1	< 0.1	< 0.1	0.33	0.14	0.67	< 0.1	0.5	< 0.1	0.8	-
Dibenzo[a,h]anthracene	1	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-
Fluoranthene		< 0.2	< 0.2	< 0.2	0.34	< 0.2	< 0.2	< 0.2	0.96	0.35	1.7	< 0.2	1.5	< 0.2	2.5	24,000
Fluorene		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.11	< 0.1	0.2	< 0.1	0.12	24,000
Indeno[1,2,3-c,d]pyrene	0.1	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.23	< 0.2	0.58	< 0.2	0.33	< 0.2	0.5	-
Naphthalene		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2,400
Phenanthrene		< 0.1	< 0.1	< 0.1	0.19	< 0.1	< 0.1	< 0.1	0.59	0.17	0.95	< 0.1	1.2	< 0.1	1.2	18,000
Pyrene		< 0.2	< 0.2	< 0.2	0.34	< 0.2	< 0.2	< 0.2	0.84	0.36	1.7	< 0.2	1.3	< 0.2	2.3	18,000
BaP equivalence [3,4]		-	-	-	***0.29***	-	-	-	***0.53***	***0.28***	***1.14***	-	***0.76***	-	***1.07***	2.7

Notes:

1. Criteria from the *Guidelines for Assessing and Managing Contaminated Gasworks Sites in New Zealand* (MfE, 1997)
2. Deeper samples were taken over a range of depths depending on when waste was first encountered in the particular hole
3. Benzo(a)pyrene equivalence calculated from the seven carcinogenic PAHs by multiplying each concentration by relevant toxic equivalence factor and summing the results.
4. Half detection limit used for calculations in cases where results are below the detection limit

Table 6: Soil Sample Results – Acid Herbicides (mg/kg)

Sample Name	Playground Composite	SW Trench Composite	Drum Excavation Composite (Surface)	Drum Excavation Composite (Deep)	**Residential Guideline Values** [1]
Laboratory Reference	58715-9	58715-10	58715-11	58715-14	
Date	15 July, 2009				
Sample Location	Playground	SW Trench	Drum Excavation		
Sub-sample Depth (m bgl)[2]	0 - 0.075	0 - 0.075	0 - 0.075	0.35 - 1.0	
Bentazone	< 0.2	< 0.2	< 0.2	< 0.2	1,800
Acifluorfen	< 0.2	< 0.2	< 0.2	< 0.2	-
Bromoxynil	< 0.2	< 0.2	< 0.2	< 0.2	1,200
Clopyralid	< 0.2	< 0.2	< 0.2	< 0.2	-
Dicamba	< 0.2	< 0.2	< 0.2	< 0.2	1,800
2,4-D	< 0.2	< 0.2	< 0.2	< 0.2	690
2,4-DB	< 0.2	< 0.2	< 0.2	< 0.2	490
Dichlorprop	< 0.2	< 0.2	< 0.2	< 0.2	-
Endothal	< 0.2	< 0.2	< 0.2	< 0.2	1,200
Fluazifop	< 0.2	< 0.2	< 0.2	< 0.2	-
Fluroxypyr	< 0.2	< 0.2	< 0.2	< 0.2	-
Haloxyfop	< 0.2	< 0.2	< 0.2	< 0.2	3.1
MCPA	< 0.2	< 0.2	< 0.2	< 0.2	31
MCPB	< 0.2	< 0.2	< 0.2	< 0.2	610
Mecoprop	< 0.2	< 0.2	< 0.2	< 0.2	-
Oryzalin	< 0.4	< 0.4	< 0.4	< 0.4	3,100
Picloram	< 0.2	< 0.2	< 0.2	< 0.2	4,300
Quizalofop	< 0.2	< 0.2	< 0.2	< 0.2	-
2,4,5-TP	< 0.2	< 0.2	< 0.2	< 0.2	-
2,4,5-T	< 0.2	< 0.2	< 0.2	< 0.2	610
Triclopyr	< 0.2	< 0.2	< 0.2	< 0.2	-

Notes:
1. Criteria from the US EPA Regional Screening Levels (US EPA, 2009)
2. Deeper samples were taken over a range of depths depending on when waste was first encountered in the particular hole
- No guideline value available

Appendix D Laboratory Reports

Hill Laboratories
BETTER TESTING BETTER RESULTS

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Private Bag 3205
Hamilton 3240, New Zealand

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Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

ANALYSIS REPORT

Client:	Pattle Delamore Partners Ltd	**Lab No:**	709708	SPv1
Contact:	R Lidgard	**Date Registered:**	17-Jul-2009	
	Pattle Delamore Partners	**Date Reported:**	28-Jul-2009	
	PO Box 9528, Newmarket	**Quote No:**		
	AUCKLAND	**Order No:**		
		Client Reference:	WO1772101	
		Submitted By:	R Lidgard	

Sample Type: Soil

Sample Name:	SS1 PLAY + SS2 PLAY + SS3 PLAY + SS4 PLAY + SS5 PLAY + SS6 PLAY (Composite)	SS7 + SS8 + SS9 + SS10 + SS11 + SS12 (Composite)	SS13/1 + SS14/1 + SS15/1 + SS16/1 + SS17/1 + SS18/1 (Composite)	SS19/1 + SS20/1 + SS21/1 + SS22/1 + SS23/1 + SS24/1 (Composite)	SS25 + SS26 + SS27 + SS28 + SS29 + SS30 + SS31 (Composite)
Lab Number:	709708.86	709708.87	709708.88	709708.89	709708.90
Individual Tests					
Dry Matter g/100g as rcvd	49	57	54	-	-
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg					
Total Recoverable Arsenic mg/kg dry wt	5.0	3.7	2.3	2.5	3.1
Total Recoverable Cadmium mg/kg dry wt	0.13	0.14	< 0.10	0.41	0.16
Total Recoverable Chromium mg/kg dry wt	16	18	9.0	6.3	16
Total Recoverable Copper mg/kg dry wt	89	120	77	42	81
Total Recoverable Lead mg/kg dry wt	15	23	11	7.9	16
Total Recoverable Mercury mg/kg dry wt	< 0.10	< 0.10	0.17	< 0.10	< 0.10
Total Recoverable Nickel mg/kg dry wt	8.6	12	5.6	7.8	11
Total Recoverable Zinc mg/kg dry wt	84	92	58	52	85
Acid Herbicides Screen in Soil by LCMSMS					
Bentazone mg/kg dry wt	< 0.2	< 0.2	< 0.2	-	-
Acifluorfen mg/kg dry wt	< 0.2	< 0.2	< 0.2	-	-
Bromoxynil mg/kg dry wt	< 0.2	< 0.2	< 0.2	-	-
Clopyralid mg/kg dry wt	< 0.2	< 0.2	< 0.2	-	-
Dicamba mg/kg dry wt	< 0.2	< 0.2	< 0.2	-	-
2,4-Dichlorophenoxyacetic acid (24D) mg/kg dry wt	< 0.2	< 0.2	< 0.2	-	-
2,4-Dichlorophenoxybutyric acid (24DB) mg/kg dry wt	< 0.2	< 0.2	< 0.2	-	-
Dichlorprop mg/kg dry wt	< 0.2	< 0.2	< 0.2	-	-
Endothal mg/kg dry wt	< 0.2	< 0.2	< 0.2	-	-
Fluazifop mg/kg dry wt	< 0.2	< 0.2	< 0.2	-	-
Fluroxypyr mg/kg dry wt	< 0.2	< 0.2	< 0.2	-	-
Haloxyfop mg/kg dry wt	< 0.2	< 0.2	< 0.2	-	-
MCPA mg/kg dry wt	< 0.2	< 0.2	< 0.2	-	-
MCPB mg/kg dry wt	< 0.2	< 0.2	< 0.2	-	-
Mecoprop mg/kg dry wt	< 0.2	< 0.2	< 0.2	-	-
Oryzalin mg/kg dry wt	< 0.4	< 0.4	< 0.4	-	-
Pentachlorophenol (PCP) mg/kg dry wt	< 0.2	< 0.2	< 0.2	-	-
Picloram mg/kg dry wt	< 0.2	< 0.2	< 0.2	-	-
Quizalofop mg/kg dry wt	< 0.2	< 0.2	< 0.2	-	-
2,3,4,6-Tetrachlorophenol* mg/kg dry wt	< 0.2	< 0.2	< 0.2	-	-

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

Sample Type: Soil						
Sample Name:		SS1 PLAY + SS2 PLAY + SS3 PLAY + SS4 PLAY + SS5 PLAY + SS6 PLAY (Composite)	SS7 + SS8 + SS9 + SS10 + SS11 + SS12 (Composite)	SS13/1 + SS14/1 + SS15/1 + SS16/1 + SS17/1 + SS18/1 (Composite)	SS19/1 + SS20/1 + SS21/1 + SS22/1 + SS23/1 + SS24/1 (Composite)	SS25 + SS26 + SS27 + SS28 + SS29 + SS30 + SS31 (Composite)
Lab Number:		709708.86	709708.87	709708.88	709708.89	709708.90
Acid Herbicides Screen in Soil by LCMSMS						
2,4,5-trichlorophenoxypropionic acid (245TP,Fenoprop, Silvex)	mg/kg dry wt	< 0.2	< 0.2	< 0.2	-	-
2,4,5-Trichlorophenoxyacetic acid (245T)	mg/kg dry wt	< 0.2	< 0.2	< 0.2	-	-
Triclopyr	mg/kg dry wt	< 0.2	< 0.2	< 0.2	-	-

Sample Name:		A3/1 + B4/1 C2/1 + D3/1 + E2/1 + F6/1 (Composite)	A11/1 + B5/1 + C1/1 + D6/1 + E3/1 + F3/1 (Composite)	A1/1 + B3/1 + C6/1 + D1/1 + E4/1 + F5/1 (Composite)	A6/1 + B2/1 + C4/1 + D2/1 + E5/1 + F8/1 (Composite)	A3/2 + B4/2 + C2/2 + D3/2 + E2/2 + F3/2 (Composite)
Lab Number:		709708.91	709708.92	709708.93	709708.94	709708.95
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	3.1	2.8	3.0	2.9	4.8
Total Recoverable Cadmium	mg/kg dry wt	0.30	0.25	0.31	0.39	0.28
Total Recoverable Chromium	mg/kg dry wt	13	12	11	12	24
Total Recoverable Copper	mg/kg dry wt	87	78	78	85	99
Total Recoverable Lead	mg/kg dry wt	15	18	15	18	200
Total Recoverable Mercury	mg/kg dry wt	< 0.10	0.25	0.13	0.12	0.70
Total Recoverable Nickel	mg/kg dry wt	7.5	6.6	6.7	7.5	12
Total Recoverable Zinc	mg/kg dry wt	68	69	62	84	190

Sample Name:		A11/2 + B5/2 + C1/2 + D6/2 + E3/2 + F3/2 (Composite)	A1/2 + B3/2 + C6/2 + D1/2 + E4/2 + F5/2 9Composite)	A6/2 + B2/2 C4/2 + D2/2 + E5/2 + F8/2 (Duplicate)	SS13/2 + SS14/2 + SS15/2 + SS16/2 + SS17/2 + SS18/2 (Composite)	
Lab Number:		709708.96	709708.97	709708.98	709708.99	
Individual Tests						
Dry Matter	g/100g as rcvd	-	-	-	58	-
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	3.5	3.4	3.1	4.9	-
Total Recoverable Cadmium	mg/kg dry wt	0.12	0.27	0.19	0.23	-
Total Recoverable Chromium	mg/kg dry wt	18	15	18	11	-
Total Recoverable Copper	mg/kg dry wt	98	95	110	89	-
Total Recoverable Lead	mg/kg dry wt	43	45	23	24	-
Total Recoverable Mercury	mg/kg dry wt	0.15	0.11	< 0.10	0.10	-
Total Recoverable Nickel	mg/kg dry wt	11	7.6	13	12	-
Total Recoverable Zinc	mg/kg dry wt	90	250	110	220	-
Acid Herbicides Screen in Soil by LCMSMS						
Bentazone	mg/kg dry wt	-	-	-	< 0.2	-
Acifluorfen	mg/kg dry wt	-	-	-	< 0.2	-
Bromoxynil	mg/kg dry wt	-	-	-	< 0.2	-
Clopyralid	mg/kg dry wt	-	-	-	< 0.2	-
Dicamba	mg/kg dry wt	-	-	-	< 0.2	-
2,4-Dichlorophenoxyacetic acid (24D)	mg/kg dry wt	-	-	-	< 0.2	-
2,4-Dichlorophenoxybutyric acid (24DB)	mg/kg dry wt	-	-	-	< 0.2	-
Dichlorprop	mg/kg dry wt	-	-	-	< 0.2	-
Endothal	mg/kg dry wt	-	-	-	< 0.2	-
Fluazifop	mg/kg dry wt	-	-	-	< 0.2	-
Fluroxypyr	mg/kg dry wt	-	-	-	< 0.2	-
Haloxyfop	mg/kg dry wt	-	-	-	< 0.2	-
MCPA	mg/kg dry wt	-	-	-	< 0.2	-
MCPB	mg/kg dry wt	-	-	-	< 0.2	-

Sample Type: Soil						
Sample Name:		A11/2 + B5/2 + C1/2 + D6/2 + E3/2 + F3/2 (Composite)	A1/2 + B3/2 + C6/2 + D1/2 + E4/2 + F5/2 9Composite)	A6/2 + B2/2 C4/2 + D2/2 + E5/2 + F8/2 (Duplicate)	SS13/2 + SS14/2 + SS15/2 + SS16/2 + SS17/2 + SS18/2 (Composite)	
Lab Number:		709708.96	709708.97	709708.98	709708.99	
Acid Herbicides Screen in Soil by LCMSMS						
Mecoprop	mg/kg dry wt	-	-	-	< 0.2	-
Oryzalin	mg/kg dry wt	-	-	-	< 0.4	-
Pentachlorophenol (PCP)	mg/kg dry wt	-	-	-	< 0.2	-
Picloram	mg/kg dry wt	-	-	-	< 0.2	-
Quizalofop	mg/kg dry wt	-	-	-	< 0.2	-
2,3,4,6-Tetrachlorophenol*	mg/kg dry wt	-	-	-	< 0.2	-
2,4,5-trichlorophenoxypropionic acid (245TP,Fenoprop, Silvex)	mg/kg dry wt	-	-	-	< 0.2	-
2,4,5-Trichlorophenoxyacetic acid (245T)	mg/kg dry wt	-	-	-	< 0.2	-
Triclopyr	mg/kg dry wt	-	-	-	< 0.2	-

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Samples**
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction.	-	86-99
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	-	86-99
Acid Herbicides Screen in Soil by LCMSMS*	Solvent extraction with sonication, dilution, analysis by LCMSMS with online SPE	-	86-88, 99
Dry Matter (Env)	Dried at 103°C (removes 3-5% more water than air dry) for 18hr, gravimetry.	0.10 g/100g as rcvd	86-88, 99
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	86-99
Composite Environmental Solid Samples*	Individual sample fractions mixed together to form a composite fraction.	-	1-80, 82-85

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental Division

1C Quadrant Drive, Gracefield
P.O. Box 31 242, Lower Hutt
Wellington, New Zealand

T 64 4 5708800
F 64 4 5708176
W www.asurequality.com

Certificate of Analysis

Date Issued: 17 Aug 2009

Client: Pattle Delamore Partners Ltd
P O Box 6136
Wellington

Attention: Rod Lidgard

Date Received: 20 Jul 2009

AsureQuality Lab. Reference: 58715

Sample Type(s): Soil

Analysis: **Chlorophenols**

Method:
The sample was acetylated and extracted into hexane. The solvent extract was analysed by gas chromatography - mass spectrometry.

Results are reported to two significant figures in milligrams per kilogram (mg/kg), equivalent to ppm, on a dry weight basis. Detection limits are reported to one significant figure.

Unless requested, original samples will be disposed of eight weeks from the date of this report.

Comments:

A. R Lister

Andrea Lister
Analyst
AsureQuality Limited

17 August 2009

Results: Chlorophenols

Sample Identification: 1A3/1; B4/1; C2/1;D3/1;E2/1;F6/1- Composite 1

Laboratory Reference: 58715-1 Date Received: 20 Jul 2009

Date Extracted: 29 Jul 2009 Date Analysed: 29 Jul 2009

Chlorophenol	Conc.¥ (mg/kg)	
phenol	<	0.2
2-chlorophenol	<	0.05
2,6-dichlorophenol	<	0.05
2,4-dichlorophenol	<	0.05
2,4,6-trichlorophenol	<	0.05
2,4,5-trichlorophenol	<	0.05
3,4,5-trichlorophenol	<	0.05
2,3,4,6-tetrachlorophenol	<	0.05
pentachlorophenol	<	0.1

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: MC Data Analyst: AL Authorised: Andrea Lister

17 August 2009

Results: Chlorophenols

Sample Identification: 2A11/1; B5/1; C1/1; D6/1; E3/1; F3/1 - Composite 2

Laboratory Reference: 58715-2 Date Received: 20 Jul 2009

Date Extracted: 29 Jul 2009 Date Analysed: 29 Jul 2009

Chlorophenol	Conc.¥ (mg/kg)	
phenol	<	0.2
2-chlorophenol	<	0.05
2,6-dichlorophenol	<	0.05
2,4-dichlorophenol	<	0.05
2,4,6-trichlorophenol	<	0.05
2,4,5-trichlorophenol	<	0.05
3,4,5-trichlorophenol	<	0.05
2,3,4,6-tetrachlorophenol	<	0.05
pentachlorophenol	<	0.1

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: MC Data Analyst: AL Authorised: Andrea Lister

17 August 2009

Results: Chlorophenols

Sample Identification: 3A1/1; B3/1; C6/1; D1/1; E4/1; F5/1 - Composite 3

Laboratory Reference: 58715-3 Date Received: 20 Jul 2009

Date Extracted: 29 Jul 2009 Date Analysed: 29 Jul 2009

Chlorophenol	Conc.¥ (mg/kg)	
phenol	<	0.2
2-chlorophenol	<	0.05
2,6-dichlorophenol	<	0.05
2,4-dichlorophenol	<	0.05
2,4,6-trichlorophenol	<	0.05
2,4,5-trichlorophenol	<	0.05
3,4,5-trichlorophenol	<	0.05
2,3,4,6-tetrachlorophenol	<	0.05
pentachlorophenol	<	0.1

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: MC Data Analyst: AL Authorised: Andrea Lister

17 August 2009

Results: Chlorophenols

Sample Identification: 4A6/1; B2/1; C4/1; D2/1; E5/1; F8/1 - Composite 4

Laboratory Reference: 58715-4 Date Received: 20 Jul 2009

Date Extracted: 29 Jul 2009 Date Analysed: 29 Jul 2009

Chlorophenol	Conc.¥ (mg/kg)	
phenol	<	0.2
2-chlorophenol	<	0.05
2,6-dichlorophenol	<	0.05
2,4-dichlorophenol	<	0.05
2,4,6-trichlorophenol	<	0.05
2,4,5-trichlorophenol	<	0.05
3,4,5-trichlorophenol	<	0.05
2,3,4,6-tetrachlorophenol	<	0.05
pentachlorophenol	<	0.1

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: MC Data Analyst: AL Authorised: Andrea Lister

17 August 2009

Results: Chlorophenols

Sample Identification: 5A3/2; B4/2; C2/2; D3/2; E2/2; F6/2 - Composite 5

Laboratory Reference: 58715-5 Date Received: 20 Jul 2009

Date Extracted: 29 Jul 2009 Date Analysed: 29 Jul 2009

Chlorophenol	Conc.¥ (mg/kg)	
phenol	<	0.2
2-chlorophenol	<	0.05
2,6-dichlorophenol	<	0.05
2,4-dichlorophenol	<	0.05
2,4,6-trichlorophenol	<	0.05
2,4,5-trichlorophenol	<	0.05
3,4,5-trichlorophenol	<	0.05
2,3,4,6-tetrachlorophenol	<	0.05
pentachlorophenol	<	0.1

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: MC Data Analyst: AL Authorised: Andrea Lister

17 August 2009

Results: Chlorophenols

Sample Identification: 6A11/2; B5/2; C1/2; D6/2; E3/2; F3/2 - Composite 6

Laboratory Reference: 58715-6 Date Received: 20 Jul 2009

Date Extracted: 29 Jul 2009 Date Analysed: 29 Jul 2009

Chlorophenol	Conc.¥ (mg/kg)	
phenol	<	0.2
2-chlorophenol	<	0.05
2,6-dichlorophenol	<	0.05
2,4-dichlorophenol	<	0.05
2,4,6-trichlorophenol	<	0.05
2,4,5-trichlorophenol	<	0.05
3,4,5-trichlorophenol	<	0.05
2,3,4,6-tetrachlorophenol	<	0.05
pentachlorophenol	<	0.1

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: MC Data Analyst: AL Authorised: Andrea Lister

17 August 2009

Results: Chlorophenols

Sample Identification: 7A1/2; B3/2; C6/2; D1/2; E4/2; F5/2 - Composite 7

Laboratory Reference: 58715-7 Date Received: 20 Jul 2009

Date Extracted: 29 Jul 2009 Date Analysed: 29 Jul 2009

Chlorophenol	Conc.¥ (mg/kg)	
phenol	<	0.2
2-chlorophenol	<	0.05
2,6-dichlorophenol	<	0.05
2,4-dichlorophenol	<	0.05
2,4,6-trichlorophenol	<	0.05
2,4,5-trichlorophenol	<	0.05
3,4,5-trichlorophenol	<	0.05
2,3,4,6-tetrachlorophenol	<	0.05
pentachlorophenol	<	0.1

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: MC Data Analyst: AL Authorised: Andrea Lister

17 August 2009

Results: Chlorophenols

Sample Identification: 8A6/2; B2/2; C4/2; D2/2; E5/2; F8/2 - Composite 8

Laboratory Reference: 58715-8 Date Received: 20 Jul 2009

Date Extracted: 29 Jul 2009 Date Analysed: 29 Jul 2009

Chlorophenol	Conc.¥ (mg/kg)	
phenol	<	0.2
2-chlorophenol	<	0.05
2,6-dichlorophenol	<	0.05
2,4-dichlorophenol	<	0.05
2,4,6-trichlorophenol	<	0.05
2,4,5-trichlorophenol	<	0.05
3,4,5-trichlorophenol	<	0.05
2,3,4,6-tetrachlorophenol	<	0.05
pentachlorophenol	<	0.1

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: MC Data Analyst: AL Authorised: Andrea Lister

17 August 2009

Results: Chlorophenols

Sample Identification: 9SS1 - SS6 - Composite 9

Laboratory Reference: 58715-9 Date Received: 20 Jul 2009

Date Extracted: 29 Jul 2009 Date Analysed: 29 Jul 2009

Chlorophenol	Conc.¥ (mg/kg)	
phenol	<	0.2
2-chlorophenol	<	0.05
2,6-dichlorophenol	<	0.05
2,4-dichlorophenol	<	0.05
2,4,6-trichlorophenol	<	0.05
2,4,5-trichlorophenol	<	0.05
3,4,5-trichlorophenol	<	0.05
2,3,4,6-tetrachlorophenol	<	0.05
pentachlorophenol	<	0.1

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: MC Data Analyst: AL Authorised: Andrea Lister

17 August 2009

Results: Chlorophenols

Sample Identification: 10SS7 -SS12 - Composite 10

Laboratory Reference: 58715-10 Date Received: 20 Jul 2009

Date Extracted: 29 Jul 2009 Date Analysed: 29 Jul 2009

Chlorophenol	Conc.¥ (mg/kg)	
phenol	<	0.2
2-chlorophenol	<	0.05
2,6-dichlorophenol	<	0.05
2,4-dichlorophenol	<	0.05
2,4,6-trichlorophenol	<	0.05
2,4,5-trichlorophenol		**0.48**
3,4,5-trichlorophenol	<	0.05
2,3,4,6-tetrachlorophenol	<	0.05
pentachlorophenol	<	0.1

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: MC Data Analyst: AL Authorised: Andrea Lister

17 August 2009

Results: Chlorophenols

Sample Identification: 11SS13/1-SS18/1 - Composite 11

Laboratory Reference: 58715-11 Date Received: 20 Jul 2009

Date Extracted: 29 Jul 2009 Date Analysed: 29 Jul 2009

Chlorophenol	Conc.¥ (mg/kg)	
phenol	<	0.2
2-chlorophenol	<	0.05
2,6-dichlorophenol	<	0.05
2,4-dichlorophenol	<	0.05
2,4,6-trichlorophenol	<	0.05
2,4,5-trichlorophenol	<	0.05
3,4,5-trichlorophenol	<	0.05
2,3,4,6-tetrachlorophenol	<	0.05
pentachlorophenol	<	0.1

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: MC Data Analyst: AL Authorised: Andrea Lister

17 August 2009

Results: Chlorophenols

Sample Identification: 12SS19 - SS24 - Composite 12

Laboratory Reference: 58715-12 Date Received: 20 Jul 2009

Date Extracted: 29 Jul 2009 Date Analysed: 29 Jul 2009

Chlorophenol	Conc.¥ (mg/kg)	
phenol	<	0.2
2-chlorophenol	<	0.05
2,6-dichlorophenol	<	0.05
2,4-dichlorophenol	<	0.05
2,4,6-trichlorophenol	<	0.05
2,4,5-trichlorophenol	<	0.05
3,4,5-trichlorophenol	<	0.05
2,3,4,6-tetrachlorophenol	<	0.05
pentachlorophenol	<	0.1

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: MC Data Analyst: AL Authorised: Andrea Lister

17 August 2009

Results: Chlorophenols

Sample Identification: 13SS25 - SS31 - Composite 13

Laboratory Reference: 58715-13 Date Received: 20 Jul 2009

Date Extracted: 29 Jul 2009 Date Analysed: 29 Jul 2009

Chlorophenol	Conc.¥ (mg/kg)	
phenol	<	0.2
2-chlorophenol	<	0.05
2,6-dichlorophenol	<	0.05
2,4-dichlorophenol	<	0.05
2,4,6-trichlorophenol	<	0.05
2,4,5-trichlorophenol	<	0.05
3,4,5-trichlorophenol	<	0.05
2,3,4,6-tetrachlorophenol	<	0.05
pentachlorophenol	<	0.1

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: MC Data Analyst: AL Authorised: Andrea Lister

17 August 2009

Results: Chlorophenols

Sample Identification: 14 SS13/2 - SS 18/2, Composite 14

Laboratory Reference: 58715-14 Date Received: 20 Jul 2009

Date Extracted: 29 Jul 2009 Date Analysed: 29 Jul 2009

Chlorophenol	Conc.¥ (mg/kg)	
phenol	<	0.2
2-chlorophenol	<	0.05
2,6-dichlorophenol	<	0.05
2,4-dichlorophenol	<	0.05
2,4,6-trichlorophenol	<	0.05
2,4,5-trichlorophenol	<	0.05
3,4,5-trichlorophenol	<	0.05
2,3,4,6-tetrachlorophenol	<	0.05
pentachlorophenol	<	0.1

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: MC Data Analyst: AL Authorised: Andrea Lister

17 August 2009

Results: Chlorophenols

Sample Identification: Laboratory Blank
Laboratory Reference: 58715/BLANK-
Date Received: Not applicable
Date Extracted: 29 Jul 2009
Date Analysed: 29 Jul 2009

Chlorophenol	Conc.¥ (mg/kg)	
phenol	<	0.2
2-chlorophenol	<	0.05
2,6-dichlorophenol	<	0.05
2,4-dichlorophenol	<	0.05
2,4,6-trichlorophenol	<	0.05
2,4,5-trichlorophenol	<	0.05
3,4,5-trichlorophenol	<	0.05
2,3,4,6-tetrachlorophenol	<	0.05
pentachlorophenol	<	0.1

¥ = Results are calculated using the average weight of samples in this batch.
< = Less than limit of detection.

Lab Analyst: MC Data Analyst: AL Authorised: Andrea Lister

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Certificate of Analysis

Date Issued: 17 Aug 2009

Client: Pattle Delamore Partners Ltd
P O Box 6136
Wellington

Attention: Rod Lidgard

Date Received: 20 Jul 2009

AsureQuality Lab. Reference: 58715

Sample Type(s): Soil

Analysis: **Semi Volatile Organic Contaminants**

Method:
The sample was extracted with organic solvent and the extract analysed by gas chromatography - mass spectrometry. Non-target compounds are identified by a mass spectral library search and where possible quantified against an authentic standard.

Results are reported to two significant figures in milligrams per kilogram (mg/kg), equivalent to ppm, on a dry weight basis. Detection limits are reported to one significant figure.

Unless requested, original samples will be disposed of eight weeks from the date of this report.

Comments:

Jayanthi Ranasinghe
Analyst
AsureQuality Limited

17 August 2009

Results: Semi Volatile Organic Contaminants

Sample Identification: 1A3/1; B4/1; C2/1;D3/1;E2/1;F6/1- Composite 1

Laboratory Reference: 58715-1 Date Received: 20 Jul 2009

Date Extracted: 31 Jul 2009 Date Analysed: 11 Aug 2009

Analyte	Conc. ¥ (mg/kg)	Analyte	Conc. ¥ (mg/kg)
Organochlorine Pesticides		**Organophosphorus Pesticides**	
hexachlorobenzene	< 0.1	Diazinon	< 0.1
gamma-BHC (lindane)	< 0.1	Pirimiphos methyl	< 0.2
heptachlor	< 0.1	Chlorpyriphos	< 0.2
aldrin	< 0.1	Azinphos methyl	< 0.8
heptachlor epoxide	< 0.1	**Plasticisers**	
Procymidone	< 0.2	dimethyl phthalate	< 2
Alpha-chlordane	< 0.1	diethyl phthalate	< 2
Gamma-chlordane	< 0.1	di-n-butyl phthalate	< 2
pp-DDE	< 0.1	benzyl butyl phthalate	< 2
dieldrin	< 0.1	di(2-ethylhexyl) adipate	< 2
pp-DDD	< 0.1	di(2-ethylhexyl) phthalate	< 2
pp-DDT	< 0.2	**Polychlorinated Biphenyls**	
Methoxychlor	< 0.2	PCB congener #8	< 0.1
Cis permethrin	< 0.2	PCB congener #28	< 0.1
Trans permethrin	< 0.2	PCB congener #101	< 0.1
alpha-BHC	< 0.1	PCB congener #138	< 0.1
beta-BHC	< 0.1	PCB congener #183	< 0.1
Delta-BHC	< 0.1	**Polycyclic Aromatic Hydrocarbons**	
endosulfan I	< 0.1	naphthalene	< 1
endosulfan II	< 0.1	acenaphthylene	< 0.1
Endosulfan sulfate	< 0.1	acenaphthene	< 0.1
endrin	< 0.1	fluorene	< 0.1
Endrin aldehyde	< 0.1	phenanthrene	< 0.1
Endrin ketone	< 0.1	anthracene	< 0.1
Organonitrogen Herbicides		fluoranthene	< 0.2
Trifluralin	< 0.2	pyrene	< 0.2
Simazine	< 0.1	benz[a]anthracene	< 0.1
Atrazine	< 0.1	chrysene	< 0.1
Terbuthylazine	< 0.2	benzo[b]fluoranthene	< 0.1
Propanil	< 0.1	benzo[k]fluoranthene	< 0.1
Alachlor	< 0.2	benzo[a]pyrene	< 0.1
Metolachlor	< 0.1	indeno[1,2,3-c,d]pyrene	< 0.2
Pendimethalin	< 0.2	dibenz[a,h]anthracene	< 0.2
Molinate	< 0.1	benzo[g,h,i]perylene	< 0.2
Propazine	< 0.1		
Hexazinone	< 0.1		
Metalaxyl	< 0.1		
Cyanazine	< 0.1		
Oxadiazon	< 0.1		
Metribuzin	< 0.1		
Bromacil	< 0.4		
Oryzalin	< 10		

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JR Authorised: Jayanthi Ranasinghe

17 August 2009

Results: Semi Volatile Organic Contaminants

Sample Identification: 2A11/1; B5/1; C1/1; D6/1; E3/1; F3/1 - Composite 2

Laboratory Reference: 58715-2 Date Received: 20 Jul 2009

Date Extracted: 31 Jul 2009 Date Analysed: 11 Aug 2009

Analyte	Conc. ¥ (mg/kg)	Analyte	Conc. ¥ (mg/kg)
Organochlorine Pesticides		**Organophosphorus Pesticides**	
hexachlorobenzene	< 0.1	Diazinon	< 0.1
gamma-BHC (lindane)	< 0.1	Pirimiphos methyl	< 0.2
heptachlor	< 0.1	Chlorpyriphos	< 0.2
aldrin	< 0.1	Azinphos methyl	< 0.8
heptachlor epoxide	< 0.1	**Plasticisers**	
Procymidone	< 0.2	dimethyl phthalate	< 2
Alpha-chlordane	< 0.1	diethyl phthalate	< 2
Gamma-chlordane	< 0.1	di-n-butyl phthalate	< 2
pp-DDE	< 0.1	benzyl butyl phthalate	< 2
dieldrin	< 0.1	di(2-ethylhexyl) adipate	< 2
pp-DDD	< 0.1	di(2-ethylhexyl) phthalate	< 2
pp-DDT	< 0.2	**Polychlorinated Biphenyls**	
Methoxychlor	< 0.2	PCB congener #8	< 0.1
Cis permethrin	< 0.2	PCB congener #28	< 0.1
Trans permethrin	< 0.2	PCB congener #101	< 0.1
alpha-BHC	< 0.1	PCB congener #138	< 0.1
beta-BHC	< 0.1	PCB congener #183	< 0.1
Delta-BHC	< 0.1	**Polycyclic Aromatic Hydrocarbons**	
endosulfan I	< 0.1	naphthalene	< 1
endosulfan II	< 0.1	acenaphthylene	< 0.1
Endosulfan sulfate	< 0.1	acenaphthene	< 0.1
endrin	< 0.1	fluorene	< 0.1
Endrin aldehyde	< 0.1	phenanthrene	**0.17**
Endrin ketone	< 0.1	anthracene	< 0.1
Organonitrogen Herbicides		fluoranthene	**0.35**
Trifluralin	< 0.2	pyrene	**0.36**
Simazine	< 0.1	benz[a]anthracene	**0.15**
Atrazine	< 0.1	chrysene	**0.14**
Terbuthylazine	< 0.2	benzo[b]fluoranthene	**0.11**
Propanil	< 0.1	benzo[k]fluoranthene	**0.11**
Alachlor	< 0.2	benzo[a]pyrene	**0.14**
Metolachlor	< 0.1	indeno[1,2,3-c,d]pyrene	< 0.2
Pendimethalin	< 0.2	dibenz[a,h]anthracene	< 0.2
Molinate	< 0.1	benzo[g,h,i]perylene	< 0.2
Propazine	< 0.1		
Hexazinone	< 0.1		
Metalaxyl	< 0.1		
Cyanazine	< 0.1		
Oxadiazon	< 0.1		
Metribuzin	< 0.1		
Bromacil	< 0.4		
Oryzalin	< 10		

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: CG Authorised: Jayanthi Ranasinghe

17 August 2009

Results: Semi Volatile Organic Contaminants

Sample Identification: 3A1/1; B3/1; C6/1; D1/1; E4/1; F5/1 - Composite 3

Laboratory Reference: 58715-3 Date Received: 20 Jul 2009

Date Extracted: 31 Jul 2009 Date Analysed: 11 Aug 2009

Analyte	Conc. ¥ (mg/kg)	Analyte	Conc. ¥ (mg/kg)
Organochlorine Pesticides		**Organophosphorus Pesticides**	
hexachlorobenzene	< 0.1	Diazinon	< 0.1
gamma-BHC (lindane)	< 0.1	Pirimiphos methyl	< 0.2
heptachlor	< 0.1	Chlorpyriphos	< 0.2
aldrin	< 0.1	Azinphos methyl	< 0.8
heptachlor epoxide	< 0.1	**Plasticisers**	
Procymidone	< 0.2	dimethyl phthalate	< 2
Alpha-chlordane	< 0.1	diethyl phthalate	< 2
Gamma-chlordane	< 0.1	di-n-butyl phthalate	< 2
pp-DDE	< 0.1	benzyl butyl phthalate	< 2
dieldrin	< 0.1	di(2-ethylhexyl) adipate	< 2
pp-DDD	< 0.1	di(2-ethylhexyl) phthalate	< 2
pp-DDT	< 0.2	**Polychlorinated Biphenyls**	
Methoxychlor	< 0.2	PCB congener #8	< 0.1
Cis permethrin	< 0.2	PCB congener #28	< 0.1
Trans permethrin	< 0.2	PCB congener #101	< 0.1
alpha-BHC	< 0.1	PCB congener #138	< 0.1
beta-BHC	< 0.1	PCB congener #183	< 0.1
Delta-BHC	< 0.1	**Polycyclic Aromatic Hydrocarbons**	
endosulfan I	< 0.1	naphthalene	< 1
endosulfan II	< 0.1	acenaphthylene	< 0.1
Endosulfan sulfate	< 0.1	acenaphthene	< 0.1
endrin	< 0.1	fluorene	< 0.1
Endrin aldehyde	< 0.1	phenanthrene	< 0.1
Endrin ketone	< 0.1	anthracene	< 0.1
Organonitrogen Herbicides		fluoranthene	< 0.2
Trifluralin	< 0.2	pyrene	< 0.2
Simazine	< 0.1	benz[a]anthracene	< 0.1
Atrazine	< 0.1	chrysene	< 0.1
Terbuthylazine	< 0.2	benzo[b]fluoranthene	< 0.1
Propanil	< 0.1	benzo[k]fluoranthene	< 0.1
Alachlor	< 0.2	benzo[a]pyrene	< 0.1
Metolachlor	< 0.1	indeno[1,2,3-c,d]pyrene	< 0.2
Pendimethalin	< 0.2	dibenz[a,h]anthracene	< 0.2
Molinate	< 0.1	benzo[g,h,i]perylene	< 0.2
Propazine	< 0.1		
Hexazinone	< 0.1		
Metalaxyl	< 0.1		
Cyanazine	< 0.1		
Oxadiazon	< 0.1		
Metribuzin	< 0.1		
Bromacil	< 0.4		
Oryzalin	< 10		

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JR Authorised: Jayanthi Ranasinghe

17 August 2009

Results: Semi Volatile Organic Contaminants

Sample Identification: 4A6/1; B2/1; C4/1; D2/1; E5/1; F8/1 - Composite 4

Laboratory Reference: 58715-4 Date Received: 20 Jul 2009

Date Extracted: 31 Jul 2009 Date Analysed: 11 Aug 2009

Analyte	Conc. ¥ (mg/kg)	Analyte	Conc. ¥ (mg/kg)
Organochlorine Pesticides		**Organophosphorus Pesticides**	
hexachlorobenzene	< 0.1	Diazinon	< 0.1
gamma-BHC (lindane)	< 0.1	Pirimiphos methyl	< 0.2
heptachlor	< 0.1	Chlorpyriphos	< 0.2
aldrin	< 0.1	Azinphos methyl	< 0.8
heptachlor epoxide	< 0.1	**Plasticisers**	
Procymidone	< 0.2	dimethyl phthalate	< 2
Alpha-chlordane	< 0.1	diethyl phthalate	< 2
Gamma-chlordane	< 0.1	di-n-butyl phthalate	< 2
pp-DDE	< 0.1	benzyl butyl phthalate	< 2
dieldrin	< 0.1	di(2-ethylhexyl) adipate	< 2
pp-DDD	< 0.1	di(2-ethylhexyl) phthalate	< 2
pp-DDT	< 0.2	**Polychlorinated Biphenyls**	
Methoxychlor	< 0.2	PCB congener #8	< 0.1
Cis permethrin	< 0.2	PCB congener #28	< 0.1
Trans permethrin	< 0.2	PCB congener #101	< 0.1
alpha-BHC	< 0.1	PCB congener #138	< 0.1
beta-BHC	< 0.1	PCB congener #183	< 0.1
Delta-BHC	< 0.1	**Polycyclic Aromatic Hydrocarbons**	
endosulfan I	< 0.1	naphthalene	< 1
endosulfan II	< 0.1	acenaphthylene	< 0.1
Endosulfan sulfate	< 0.1	acenaphthene	< 0.1
endrin	< 0.1	fluorene	< 0.1
Endrin aldehyde	< 0.1	phenanthrene	< 0.1
Endrin ketone	< 0.1	anthracene	< 0.1
Organonitrogen Herbicides		fluoranthene	< 0.2
Trifluralin	< 0.2	pyrene	< 0.2
Simazine	< 0.1	benz[a]anthracene	< 0.1
Atrazine	< 0.1	chrysene	< 0.1
Terbuthylazine	< 0.2	benzo[b]fluoranthene	< 0.1
Propanil	< 0.1	benzo[k]fluoranthene	< 0.1
Alachlor	< 0.2	benzo[a]pyrene	< 0.1
Metolachlor	< 0.1	indeno[1,2,3-c,d]pyrene	< 0.2
Pendimethalin	< 0.2	dibenz[a,h]anthracene	< 0.2
Molinate	< 0.1	benzo[g,h,i]perylene	< 0.2
Propazine	< 0.1		
Hexazinone	< 0.1		
Metalaxyl	< 0.1		
Cyanazine	< 0.1		
Oxadiazon	< 0.1		
Metribuzin	< 0.1		
Bromacil	< 0.4		
Oryzalin	< 10		

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JR Authorised: Jayanthi Ranasinghe

17 August 2009

Results: Semi Volatile Organic Contaminants

Sample Identification: 5A3/2; B4/2; C2/2; D3/2; E2/2; F6/2 - Composite 5

Laboratory Reference: 58715-5 Date Received: 20 Jul 2009

Date Extracted: 31 Jul 2009 Date Analysed: 11 Aug 2009

Analyte	Conc. ¥ (mg/kg)	Analyte	Conc. ¥ (mg/kg)
Organochlorine Pesticides		**Organophosphorus Pesticides**	
hexachlorobenzene	< 0.1	Diazinon	< 0.1
gamma-BHC (lindane)	< 0.1	Pirimiphos methyl	< 0.2
heptachlor	< 0.1	Chlorpyriphos	< 0.2
aldrin	< 0.1	Azinphos methyl	< 0.8
heptachlor epoxide	< 0.1	**Plasticisers**	
Procymidone	< 0.2	dimethyl phthalate	< 2
Alpha-chlordane	< 0.1	diethyl phthalate	< 2
Gamma-chlordane	< 0.1	di-n-butyl phthalate	< 2
pp-DDE	< 0.1	benzyl butyl phthalate	< 2
dieldrin	< 0.1	di(2-ethylhexyl) adipate	< 2
pp-DDD	< 0.1	di(2-ethylhexyl) phthalate	< 2
pp-DDT	< 0.2	**Polychlorinated Biphenyls**	
Methoxychlor	< 0.2	PCB congener #8	< 0.1
Cis permethrin	< 0.2	PCB congener #28	< 0.1
Trans permethrin	< 0.2	PCB congener #101	< 0.1
alpha-BHC	< 0.1	PCB congener #138	< 0.1
beta-BHC	< 0.1	PCB congener #183	< 0.1
Delta-BHC	< 0.1	**Polycyclic Aromatic Hydrocarbons**	
endosulfan I	< 0.1	naphthalene	< 1
endosulfan II	< 0.1	acenaphthylene	< 0.1
Endosulfan sulfate	< 0.1	acenaphthene	< 0.2
endrin	< 0.1	fluorene	< 0.1
Endrin aldehyde	< 0.1	phenanthrene	**0.59**
Endrin ketone	< 0.1	anthracene	**0.18**
Organonitrogen Herbicides		fluoranthene	**0.96**
Trifluralin	< 0.2	pyrene	**0.84**
Simazine	< 0.1	benz[a]anthracene	**0.35**
Atrazine	< 0.1	chrysene	**0.33**
Terbuthylazine	< 0.2	benzo[b]fluoranthene	**0.28**
Propanil	< 0.1	benzo[k]fluoranthene	**0.28**
Alachlor	< 0.2	benzo[a]pyrene	**0.34**
Metolachlor	< 0.1	indeno[1,2,3-c,d]pyrene	**0.23**
Pendimethalin	< 0.2	dibenz[a,h]anthracene	< 0.2
Molinate	< 0.1	benzo[g,h,i]perylene	**0.21**
Propazine	< 0.1		
Hexazinone	< 0.1		
Metalaxyl	< 0.1		
Cyanazine	< 0.1		
Oxadiazon	< 0.1		
Metribuzin	< 0.1		
Bromacil	< 0.4		
Oryzalin	< 10		

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: CG Authorised: Jayanthi Ranasinghe

17 August 2009

Results: Semi Volatile Organic Contaminants

Sample Identification: 6A11/2; B5/2; C1/2; D6/2; E3/2; F3/2 - Composite 6

Laboratory Reference: 58715-6 Date Received: 20 Jul 2009

Date Extracted: 31 Jul 2009 Date Analysed: 11 Aug 2009

Analyte	Conc. ¥ (mg/kg)	Analyte	Conc. ¥ (mg/kg)
Organochlorine Pesticides		**Organophosphorus Pesticides**	
hexachlorobenzene	< 0.1	Diazinon	< 0.1
gamma-BHC (lindane)	< 0.1	Pirimiphos methyl	< 0.2
heptachlor	< 0.1	Chlorpyriphos	< 0.2
aldrin	< 0.1	Azinphos methyl	< 0.8
heptachlor epoxide	< 0.1	**Plasticisers**	
Procymidone	< 0.2	dimethyl phthalate	< 2
Alpha-chlordane	< 0.1	diethyl phthalate	< 2
Gamma-chlordane	< 0.1	di-n-butyl phthalate	< 2
pp-DDE	< 0.1	benzyl butyl phthalate	< 2
dieldrin	< 0.1	di(2-ethylhexyl) adipate	< 2
pp-DDD	< 0.1	di(2-ethylhexyl) phthalate	< 2
pp-DDT	< 0.2	**Polychlorinated Biphenyls**	
Methoxychlor	< 0.2	PCB congener #8	< 0.1
Cis permethrin	< 0.2	PCB congener #28	< 0.1
Trans permethrin	< 0.2	PCB congener #101	< 0.1
alpha-BHC	< 0.1	PCB congener #138	< 0.1
beta-BHC	< 0.1	PCB congener #183	< 0.1
Delta-BHC	< 0.1	**Polycyclic Aromatic Hydrocarbons**	
endosulfan I	< 0.1	naphthalene	< 1
endosulfan II	< 0.1	acenaphthylene	< 0.2
Endosulfan sulfate	< 0.1	acenaphthene	< 0.2
endrin	< 0.1	fluorene	**0.11**
Endrin aldehyde	< 0.1	phenanthrene	**0.95**
Endrin ketone	< 0.1	anthracene	**0.23**
Organonitrogen Herbicides		fluoranthene	**1.7**
Trifluralin	< 0.2	pyrene	**1.7**
Simazine	< 0.1	benz[a]anthracene	**0.68**
Atrazine	< 0.1	chrysene	**0.67**
Terbuthylazine	< 0.2	benzo[b]fluoranthene	**0.61**
Propanil	< 0.1	benzo[k]fluoranthene	**0.60**
Alachlor	< 0.2	benzo[a]pyrene	**0.85**
Metolachlor	< 0.1	indeno[1,2,3-c,d]pyrene	**0.58**
Pendimethalin	< 0.2	dibenz[a,h]anthracene	< 0.2
Molinate	< 0.1	benzo[g,h,i]perylene	**0.56**
Propazine	< 0.1		
Hexazinone	< 0.1		
Metalaxyl	< 0.1		
Cyanazine	< 0.1		
Oxadiazon	< 0.1		
Metribuzin	< 0.1		
Bromacil	< 0.4		
Oryzalin	< 10		

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: JR Data Analyst: CG Authorised: Jayanthi Ranasinghe

17 August 2009

Results: Semi Volatile Organic Contaminants

Sample Identification: 7A1/2; B3/2; C6/2; D1/2; E4/2; F5/2 - Composite 7

Laboratory Reference: 58715-7 Date Received: 20 Jul 2009

Date Extracted: 31 Jul 2009 Date Analysed: 11 Aug 2009

Analyte	Conc. ¥ (mg/kg)	Analyte	Conc. ¥ (mg/kg)
Organochlorine Pesticides		**Organophosphorus Pesticides**	
hexachlorobenzene	< 0.1	Diazinon	< 0.1
gamma-BHC (lindane)	< 0.1	Pirimiphos methyl	< 0.2
heptachlor	< 0.1	Chlorpyriphos	< 0.2
aldrin	< 0.1	Azinphos methyl	< 0.8
heptachlor epoxide	< 0.1	**Plasticisers**	
Procymidone	< 0.2	dimethyl phthalate	< 2
Alpha-chlordane	< 0.1	diethyl phthalate	< 2
Gamma-chlordane	< 0.1	di-n-butyl phthalate	< 2
pp-DDE	< 0.1	benzyl butyl phthalate	< 2
dieldrin	< 0.1	di(2-ethylhexyl) adipate	< 2
pp-DDD	< 0.1	di(2-ethylhexyl) phthalate	< 2
pp-DDT	< 0.2	**Polychlorinated Biphenyls**	
Methoxychlor	< 0.2	PCB congener #8	< 0.1
Cis permethrin	< 0.2	PCB congener #28	< 0.1
Trans permethrin	< 0.2	PCB congener #101	< 0.1
alpha-BHC	< 0.1	PCB congener #138	< 0.1
beta-BHC	< 0.1	PCB congener #183	< 0.1
Delta-BHC	< 0.1	**Polycyclic Aromatic Hydrocarbons**	
endosulfan I	< 0.1	naphthalene	< 1
endosulfan II	< 0.1	acenaphthylene	< 0.1
Endosulfan sulfate	< 0.1	acenaphthene	< 0.3
endrin	< 0.1	fluorene	**0.20**
Endrin aldehyde	< 0.1	phenanthrene	**1.2**
Endrin ketone	< 0.1	anthracene	**0.32**
Organonitrogen Herbicides		fluoranthene	**1.5**
Trifluralin	< 0.2	pyrene	**1.3**
Simazine	< 0.1	benz[a]anthracene	**0.52**
Atrazine	< 0.1	chrysene	**0.50**
Terbuthylazine	< 0.2	benzo[b]fluoranthene	**0.45**
Propanil	< 0.1	benzo[k]fluoranthene	**0.40**
Alachlor	< 0.2	benzo[a]pyrene	**0.53**
Metolachlor	< 0.1	indeno[1,2,3-c,d]pyrene	**0.33**
Pendimethalin	< 0.2	dibenz[a,h]anthracene	< 0.2
Molinate	< 0.1	benzo[g,h,i]perylene	**0.30**
Propazine	< 0.1		
Hexazinone	< 0.1		
Metalaxyl	< 0.1		
Cyanazine	< 0.1		
Oxadiazon	< 0.1		
Metribuzin	< 0.1		
Bromacil	< 0.4		
Oryzalin	< 10		

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: CG Authorised: Jayanthi Ranasinghe

17 August 2009

Results: Semi Volatile Organic Contaminants

Sample Identification: 8A6/2; B2/2; C4/2; D2/2; E5/2; F8/2 - Composite 8

Laboratory Reference: 58715-8 Date Received: 20 Jul 2009

Date Extracted: 31 Jul 2009 Date Analysed: 11 Aug 2009

Analyte	Conc. ¥ (mg/kg)	Analyte	Conc. ¥ (mg/kg)
Organochlorine Pesticides		**Organophosphorus Pesticides**	
hexachlorobenzene	< 0.1	Diazinon	< 0.1
gamma-BHC (lindane)	< 0.1	Pirimiphos methyl	< 0.2
heptachlor	< 0.1	Chlorpyriphos	< 0.2
aldrin	< 0.1	Azinphos methyl	< 0.8
heptachlor epoxide	< 0.1	**Plasticisers**	
Procymidone	< 0.2	dimethyl phthalate	< 2
Alpha-chlordane	< 0.1	diethyl phthalate	< 2
Gamma-chlordane	< 0.1	di-n-butyl phthalate	< 2
pp-DDE	< 0.1	benzyl butyl phthalate	< 2
dieldrin	< 0.1	di(2-ethylhexyl) adipate	< 2
pp-DDD	< 0.1	di(2-ethylhexyl) phthalate	< 2
pp-DDT	< 0.2	**Polychlorinated Biphenyls**	
Methoxychlor	< 0.2	PCB congener #8	< 0.1
Cis permethrin	< 0.2	PCB congener #28	< 0.1
Trans permethrin	< 0.2	PCB congener #101	< 0.2
alpha-BHC	< 0.1	PCB congener #138	< 0.1
beta-BHC	< 0.1	PCB congener #183	< 0.1
Delta-BHC	< 0.1	**Polycyclic Aromatic Hydrocarbons**	
endosulfan I	< 0.1	naphthalene	< 1
endosulfan II	< 0.1	acenaphthylene	< 0.2
Endosulfan sulfate	< 0.1	acenaphthene	< 0.1
endrin	< 0.1	fluorene	**0.12**
Endrin aldehyde	< 0.1	phenanthrene	**1.2**
Endrin ketone	< 0.1	anthracene	**0.31**
Organonitrogen Herbicides		fluoranthene	**2.5**
Trifluralin	< 0.2	pyrene	**2.3**
Simazine	< 0.1	benz[a]anthracene	**0.83**
Atrazine	< 0.1	chrysene	**0.80**
Terbuthylazine	< 0.2	benzo[b]fluoranthene	**0.62**
Propanil	< 0.1	benzo[k]fluoranthene	**0.65**
Alachlor	< 0.2	benzo[a]pyrene	**0.77**
Metolachlor	< 0.1	indeno[1,2,3-c,d]pyrene	**0.50**
Pendimethalin	< 0.2	dibenz[a,h]anthracene	< 0.2
Molinate	< 0.1	benzo[g,h,i]perylene	**0.46**
Propazine	< 0.1		
Hexazinone	< 0.1		
Metalaxyl	< 0.1		
Cyanazine	< 0.1		
Oxadiazon	< 0.1		
Metribuzin	< 0.1		
Bromacil	< 0.4		
Oryzalin	< 10		

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: CG Authorised: Jayanthi Ranasinghe

17 August 2009

Results: Semi Volatile Organic Contaminants

Sample Identification: 9SS1 - SS6 - Composite 9

Laboratory Reference: 58715-9 Date Received: 20 Jul 2009

Date Extracted: 31 Jul 2009 Date Analysed: 11 Aug 2009

Analyte	Conc. ¥ (mg/kg)	Analyte	Conc. ¥ (mg/kg)
Organochlorine Pesticides		**Organophosphorus Pesticides**	
hexachlorobenzene	< 0.1	Diazinon	< 0.1
gamma-BHC (lindane)	< 0.1	Pirimiphos methyl	< 0.2
heptachlor	< 0.1	Chlorpyriphos	< 0.2
aldrin	< 0.1	Azinphos methyl	< 0.8
heptachlor epoxide	< 0.1	**Plasticisers**	
Procymidone	< 0.2	dimethyl phthalate	< 2
Alpha-chlordane	< 0.1	diethyl phthalate	< 2
Gamma-chlordane	< 0.1	di-n-butyl phthalate	< 2
pp-DDE	< 0.1	benzyl butyl phthalate	< 2
dieldrin	< 0.1	di(2-ethylhexyl) adipate	< 2
pp-DDD	< 0.1	di(2-ethylhexyl) phthalate	< 2
pp-DDT	< 0.2	**Polychlorinated Biphenyls**	
Methoxychlor	< 0.2	PCB congener #8	< 0.1
Cis permethrin	< 0.2	PCB congener #28	< 0.1
Trans permethrin	< 0.2	PCB congener #101	< 0.1
alpha-BHC	< 0.1	PCB congener #138	< 0.1
beta-BHC	< 0.1	PCB congener #183	< 0.1
Delta-BHC	< 0.1	**Polycyclic Aromatic Hydrocarbons**	
endosulfan I	< 0.1	naphthalene	< 1
endosulfan II	< 0.1	acenaphthylene	< 0.1
Endosulfan sulfate	< 0.1	acenaphthene	< 0.1
endrin	< 0.1	fluorene	< 0.1
Endrin aldehyde	< 0.1	phenanthrene	< 0.1
Endrin ketone	< 0.1	anthracene	< 0.1
Organonitrogen Herbicides		fluoranthene	< 0.2
Trifluralin	< 0.2	pyrene	< 0.2
Simazine	< 0.1	benz[a]anthracene	< 0.1
Atrazine	< 0.1	chrysene	< 0.1
Terbuthylazine	< 0.2	benzo[b]fluoranthene	< 0.1
Propanil	< 0.1	benzo[k]fluoranthene	< 0.1
Alachlor	< 0.2	benzo[a]pyrene	< 0.1
Metolachlor	< 0.1	indeno[1,2,3-c,d]pyrene	< 0.2
Pendimethalin	< 0.2	dibenz[a,h]anthracene	< 0.2
Molinate	< 0.1	benzo[g,h,i]perylene	< 0.2
Propazine	< 0.1		
Hexazinone	< 0.1		
Metalaxyl	< 0.1		
Cyanazine	< 0.1		
Oxadiazon	< 0.1		
Metribuzin	< 0.1		
Bromacil	< 0.4		
Oryzalin	< 10		

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JR Authorised: Jayanthi Ranasinghe

17 August 2009

Results: Semi Volatile Organic Contaminants

Sample Identification: 10SS7 -SS12 - Composite 10

Laboratory Reference: 58715-10 Date Received: 20 Jul 2009

Date Extracted: 31 Jul 2009 Date Analysed: 11 Aug 2009

Analyte	Conc. ¥ (mg/kg)	Analyte	Conc. ¥ (mg/kg)
Organochlorine Pesticides		**Organophosphorus Pesticides**	
hexachlorobenzene	< 0.1	Diazinon	< 0.1
gamma-BHC (lindane)	< 0.1	Pirimiphos methyl	< 0.2
heptachlor	< 0.1	Chlorpyriphos	< 0.2
aldrin	< 0.1	Azinphos methyl	< 0.8
heptachlor epoxide	< 0.1	**Plasticisers**	
Procymidone	< 0.2	dimethyl phthalate	< 2
Alpha-chlordane	< 0.1	diethyl phthalate	< 2
Gamma-chlordane	< 0.1	di-n-butyl phthalate	< 2
pp-DDE	< 0.1	benzyl butyl phthalate	< 2
dieldrin	< 0.1	di(2-ethylhexyl) adipate	< 2
pp-DDD	< 0.1	di(2-ethylhexyl) phthalate	< 2
pp-DDT	< 0.2	**Polychlorinated Biphenyls**	
Methoxychlor	< 0.2	PCB congener #8	< 0.1
Cis permethrin	< 0.2	PCB congener #28	< 0.1
Trans permethrin	< 0.2	PCB congener #101	< 0.1
alpha-BHC	< 0.1	PCB congener #138	< 0.1
beta-BHC	< 0.1	PCB congener #183	< 0.1
Delta-BHC	< 0.1	**Polycyclic Aromatic Hydrocarbons**	
endosulfan I	< 0.1	naphthalene	< 1
endosulfan II	< 0.1	acenaphthylene	< 0.1
Endosulfan sulfate	< 0.1	acenaphthene	< 0.1
endrin	< 0.1	fluorene	< 0.1
Endrin aldehyde	< 0.1	phenanthrene	< 0.1
Endrin ketone	< 0.1	anthracene	< 0.1
Organonitrogen Herbicides		fluoranthene	< 0.2
Trifluralin	< 0.2	pyrene	< 0.2
Simazine	< 0.1	benz[a]anthracene	< 0.1
Atrazine	< 0.1	chrysene	< 0.1
Terbuthylazine	< 0.2	benzo[b]fluoranthene	< 0.1
Propanil	< 0.1	benzo[k]fluoranthene	< 0.1
Alachlor	< 0.2	benzo[a]pyrene	< 0.1
Metolachlor	< 0.1	indeno[1,2,3-c,d]pyrene	< 0.2
Pendimethalin	< 0.2	dibenz[a,h]anthracene	< 0.2
Molinate	< 0.1	benzo[g,h,i]perylene	< 0.2
Propazine	< 0.1		
Hexazinone	< 0.1		
Metalaxyl	< 0.1		
Cyanazine	< 0.1		
Oxadiazon	< 0.1		
Metribuzin	< 0.1		
Bromacil	< 0.4		
Oryzalin	< 10		

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JR Authorised: Jayanthi Ranasinghe

17 August 2009

Results: Semi Volatile Organic Contaminants

Sample Identification: 11SS13/1-SS18/1 - Composite 11

Laboratory Reference: 58715-11 Date Received: 20 Jul 2009

Date Extracted: 31 Jul 2009 Date Analysed: 11 Aug 2009

Analyte	Conc. ¥ (mg/kg)	Analyte	Conc. ¥ (mg/kg)
Organochlorine Pesticides		**Organophosphorus Pesticides**	
hexachlorobenzene	< 0.1	Diazinon	< 0.1
gamma-BHC (lindane)	< 0.1	Pirimiphos methyl	< 0.2
heptachlor	< 0.1	Chlorpyriphos	< 0.2
aldrin	< 0.1	Azinphos methyl	< 0.8
heptachlor epoxide	< 0.1	**Plasticisers**	
Procymidone	< 0.2	dimethyl phthalate	< 2
Alpha-chlordane	< 0.1	diethyl phthalate	< 2
Gamma-chlordane	< 0.1	di-n-butyl phthalate	< 2
pp-DDE	< 0.1	benzyl butyl phthalate	< 2
dieldrin	< 0.1	di(2-ethylhexyl) adipate	< 2
pp-DDD	< 0.1	di(2-ethylhexyl) phthalate	< 2
pp-DDT	< 0.2	**Polychlorinated Biphenyls**	
Methoxychlor	< 0.2	PCB congener #8	< 0.1
Cis permethrin	< 0.2	PCB congener #28	< 0.1
Trans permethrin	< 0.2	PCB congener #101	< 0.1
alpha-BHC	< 0.1	PCB congener #138	< 0.1
beta-BHC	< 0.1	PCB congener #183	< 0.1
Delta-BHC	< 0.1	**Polycyclic Aromatic Hydrocarbons**	
endosulfan I	< 0.1	naphthalene	< 1
endosulfan II	< 0.1	acenaphthylene	< 0.1
Endosulfan sulfate	< 0.1	acenaphthene	< 0.1
endrin	< 0.1	fluorene	< 0.1
Endrin aldehyde	< 0.1	phenanthrene	< 0.1
Endrin ketone	< 0.1	anthracene	< 0.1
Organonitrogen Herbicides		fluoranthene	< 0.2
Trifluralin	< 0.2	pyrene	< 0.2
Simazine	< 0.1	benz[a]anthracene	< 0.1
Atrazine	< 0.1	chrysene	< 0.1
Terbuthylazine	< 0.2	benzo[b]fluoranthene	< 0.1
Propanil	< 0.1	benzo[k]fluoranthene	< 0.1
Alachlor	< 0.2	benzo[a]pyrene	< 0.1
Metolachlor	< 0.1	indeno[1,2,3-c,d]pyrene	< 0.2
Pendimethalin	< 0.2	dibenz[a,h]anthracene	< 0.2
Molinate	< 0.1	benzo[g,h,i]perylene	< 0.2
Propazine	< 0.1		
Hexazinone	< 0.1		
Metalaxyl	< 0.1		
Cyanazine	< 0.1		
Oxadiazon	< 0.1		
Metribuzin	< 0.1		
Bromacil	< 0.4		
Oryzalin	< 10		

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JR Authorised: Jayanthi Ranasinghe

17 August 2009

Results: Semi Volatile Organic Contaminants

Sample Identification: 12SS19 - SS24 - Composite 12

Laboratory Reference: 58715-12 Date Received: 20 Jul 2009

Date Extracted: 31 Jul 2009 Date Analysed: 11 Aug 2009

Analyte	Conc. ¥ (mg/kg)	Analyte	Conc. ¥ (mg/kg)
Organochlorine Pesticides		**Organophosphorus Pesticides**	
hexachlorobenzene	< 0.1	Diazinon	< 0.1
gamma-BHC (lindane)	< 0.1	Pirimiphos methyl	< 0.2
heptachlor	< 0.1	Chlorpyriphos	< 0.2
aldrin	< 0.1	Azinphos methyl	< 0.8
heptachlor epoxide	< 0.1	**Plasticisers**	
Procymidone	< 0.2	dimethyl phthalate	< 2
Alpha-chlordane	< 0.1	diethyl phthalate	< 2
Gamma-chlordane	< 0.1	di-n-butyl phthalate	< 2
pp-DDE	< 0.1	benzyl butyl phthalate	< 2
dieldrin	< 0.1	di(2-ethylhexyl) adipate	< 2
pp-DDD	< 0.1	di(2-ethylhexyl) phthalate	< 2
pp-DDT	< 0.2	**Polychlorinated Biphenyls**	
Methoxychlor	< 0.2	PCB congener #8	< 0.1
Cis permethrin	< 0.2	PCB congener #28	< 0.1
Trans permethrin	< 0.2	PCB congener #101	< 0.1
alpha-BHC	< 0.1	PCB congener #138	< 0.1
beta-BHC	< 0.1	PCB congener #183	< 0.1
Delta-BHC	< 0.1	**Polycyclic Aromatic Hydrocarbons**	
endosulfan I	< 0.1	naphthalene	< 1
endosulfan II	< 0.1	acenaphthylene	< 0.1
Endosulfan sulfate	< 0.1	acenaphthene	< 0.1
endrin	< 0.1	fluorene	< 0.1
Endrin aldehyde	< 0.1	phenanthrene	< 0.1
Endrin ketone	< 0.1	anthracene	< 0.1
Organonitrogen Herbicides		fluoranthene	< 0.2
Trifluralin	< 0.2	pyrene	< 0.2
Simazine	< 0.1	benz[a]anthracene	< 0.1
Atrazine	< 0.1	chrysene	< 0.1
Terbuthylazine	< 0.2	benzo[b]fluoranthene	< 0.1
Propanil	< 0.1	benzo[k]fluoranthene	< 0.1
Alachlor	< 0.2	benzo[a]pyrene	< 0.1
Metolachlor	< 0.1	indeno[1,2,3-c,d]pyrene	< 0.2
Pendimethalin	< 0.2	dibenz[a,h]anthracene	< 0.2
Molinate	< 0.1	benzo[g,h,i]perylene	< 0.2
Propazine	< 0.1		
Hexazinone	< 0.1		
Metalaxyl	< 0.1		
Cyanazine	< 0.1		
Oxadiazon	< 0.1		
Metribuzin	< 0.1		
Bromacil	< 0.4		
Oryzalin	< 10		

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JR Authorised: Jayanthi Ranasinghe

17 August 2009

Results: Semi Volatile Organic Contaminants

Sample Identification: 13SS25 - SS31 - Composite 13

Laboratory Reference: 58715-13 Date Received: 20 Jul 2009

Date Extracted: 31 Jul 2009 Date Analysed: 11 Aug 2009

Analyte	Conc. ¥ (mg/kg)	Analyte	Conc. ¥ (mg/kg)
Organochlorine Pesticides		**Organophosphorus Pesticides**	
hexachlorobenzene	< 0.1	Diazinon	< 0.1
gamma-BHC (lindane)	< 0.1	Pirimiphos methyl	< 0.2
heptachlor	< 0.1	Chlorpyriphos	< 0.2
aldrin	< 0.1	Azinphos methyl	< 0.8
heptachlor epoxide	< 0.1	**Plasticisers**	
Procymidone	< 0.2	dimethyl phthalate	< 2
Alpha-chlordane	< 0.1	diethyl phthalate	< 2
Gamma-chlordane	< 0.1	di-n-butyl phthalate	< 2
pp-DDE	< 0.1	benzyl butyl phthalate	< 2
dieldrin	< 0.1	di(2-ethylhexyl) adipate	< 2
pp-DDD	< 0.1	di(2-ethylhexyl) phthalate	< 2
pp-DDT	< 0.2	**Polychlorinated Biphenyls**	
Methoxychlor	< 0.2	PCB congener #8	< 0.1
Cis permethrin	< 0.2	PCB congener #28	< 0.1
Trans permethrin	< 0.2	PCB congener #101	< 0.1
alpha-BHC	< 0.1	PCB congener #138	< 0.1
beta-BHC	< 0.1	PCB congener #183	< 0.1
Delta-BHC	< 0.1	**Polycyclic Aromatic Hydrocarbons**	
endosulfan I	< 0.1	naphthalene	< 1
endosulfan II	< 0.1	acenaphthylene	< 0.1
Endosulfan sulfate	< 0.1	acenaphthene	< 0.1
endrin	< 0.1	fluorene	< 0.1
Endrin aldehyde	< 0.1	phenanthrene	< 0.1
Endrin ketone	< 0.1	anthracene	< 0.1
Organonitrogen Herbicides		fluoranthene	< 0.2
Trifluralin	< 0.2	pyrene	< 0.2
Simazine	< 0.1	benz[a]anthracene	< 0.1
Atrazine	< 0.1	chrysene	< 0.1
Terbuthylazine	< 0.2	benzo[b]fluoranthene	< 0.1
Propanil	< 0.1	benzo[k]fluoranthene	< 0.1
Alachlor	< 0.2	benzo[a]pyrene	< 0.1
Metolachlor	< 0.1	indeno[1,2,3-c,d]pyrene	< 0.2
Pendimethalin	< 0.2	dibenz[a,h]anthracene	< 0.2
Molinate	< 0.1	benzo[g,h,i]perylene	< 0.2
Propazine	< 0.1		
Hexazinone	< 0.1		
Metalaxyl	< 0.1		
Cyanazine	< 0.1		
Oxadiazon	< 0.1		
Metribuzin	< 0.1		
Bromacil	< 0.4		
Oryzalin	< 10		

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JR Authorised: Jayanthi Ranasinghe

17 August 2009

Results: Semi Volatile Organic Contaminants

Sample Identification: 14 SS13/2 - SS 18/2, Composite 14

Laboratory Reference: 58715-14 Date Received: 20 Jul 2009

Date Extracted: 31 Jul 2009 Date Analysed: 11 Aug 2009

Analyte	Conc. ¥ (mg/kg)	Analyte	Conc. ¥ (mg/kg)
Organochlorine Pesticides		**Organophosphorus Pesticides**	
hexachlorobenzene	< 0.1	Diazinon	< 0.1
gamma-BHC (lindane)	< 0.1	Pirimiphos methyl	< 0.2
heptachlor	< 0.1	Chlorpyriphos	< 0.2
aldrin	< 0.1	Azinphos methyl	< 0.8
heptachlor epoxide	< 0.1	**Plasticisers**	
Procymidone	< 0.2	dimethyl phthalate	< 2
Alpha-chlordane	< 0.1	diethyl phthalate	< 2
Gamma-chlordane	< 0.1	di-n-butyl phthalate	< 2
pp-DDE	< 0.1	benzyl butyl phthalate	< 2
dieldrin	< 0.2	di(2-ethylhexyl) adipate	< 2
pp-DDD	< 0.1	di(2-ethylhexyl) phthalate	< 2
pp-DDT	< 0.2	**Polychlorinated Biphenyls**	
Methoxychlor	< 0.2	PCB congener #8	< 0.1
Cis permethrin	< 0.2	PCB congener #28	< 0.1
Trans permethrin	< 0.2	PCB congener #101	< 0.1
alpha-BHC	< 0.1	PCB congener #138	< 0.1
beta-BHC	< 0.1	PCB congener #183	< 0.1
Delta-BHC	< 0.1	**Polycyclic Aromatic Hydrocarbons**	
endosulfan I	< 0.1	naphthalene	< 1
endosulfan II	< 0.1	acenaphthylene	< 0.1
Endosulfan sulfate	< 0.1	acenaphthene	< 0.1
endrin	< 0.1	fluorene	< 0.1
Endrin aldehyde	< 0.1	phenanthrene	**0.19**
Endrin ketone	< 0.1	anthracene	< 0.1
Organonitrogen Herbicides		fluoranthene	**0.34**
Trifluralin	< 0.2	pyrene	**0.34**
Simazine	< 0.1	benz[a]anthracene	**0.12**
Atrazine	< 0.1	chrysene	**0.14**
Terbuthylazine	< 0.2	benzo[b]fluoranthene	**0.12**
Propanil	< 0.1	benzo[k]fluoranthene	**0.14**
Alachlor	< 0.2	benzo[a]pyrene	**0.15**
Metolachlor	< 0.1	indeno[1,2,3-c,d]pyrene	< 0.2
Pendimethalin	< 0.2	dibenz[a,h]anthracene	< 0.2
Molinate	< 0.1	benzo[g,h,i]perylene	< 0.2
Propazine	< 0.1		
Hexazinone	< 0.1		
Metalaxyl	< 0.1		
Cyanazine	< 0.1		
Oxadiazon	< 0.1		
Metribuzin	< 0.1		
Bromacil	< 0.4		
Oryzalin	< 10		

¥ = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: CG Authorised: Jayanthi Ranasinghe

17 August 2009

Results: Semi Volatile Organic Contaminants

Sample Identification: Laboratory Blank

Laboratory Reference: 58715/BLANK-A

Date Received: Not applicable

Date Extracted: 31 Jul 2009

Date Analysed: 11 Aug 2009

Analyte	Conc. ¥ (mg/kg)	Analyte	Conc. ¥ (mg/kg)
Organochlorine Pesticides		**Organophosphorus Pesticides**	
hexachlorobenzene	< 0.1	Diazinon	< 0.1
gamma-BHC (lindane)	< 0.1	Pirimiphos methyl	< 0.2
heptachlor	< 0.1	Chlorpyriphos	< 0.2
aldrin	< 0.1	Azinphos methyl	< 0.8
heptachlor epoxide	< 0.1	**Plasticisers**	
Procymidone	< 0.2	dimethyl phthalate	< 2
Alpha-chlordane	< 0.1	diethyl phthalate	< 2
Gamma-chlordane	< 0.1	di-n-butyl phthalate	< 2
pp-DDE	< 0.1	benzyl butyl phthalate	< 2
dieldrin	< 0.1	di(2-ethylhexyl) adipate	< 2
pp-DDD	< 0.1	di(2-ethylhexyl) phthalate	< 2
pp-DDT	< 0.2	**Polychlorinated Biphenyls**	
Methoxychlor	< 0.2	PCB congener #8	< 0.1
Cis permethrin	< 0.2	PCB congener #28	< 0.1
Trans permethrin	< 0.2	PCB congener #101	< 0.1
alpha-BHC	< 0.1	PCB congener #138	< 0.1
beta-BHC	< 0.1	PCB congener #183	< 0.1
Delta-BHC	< 0.1	**Polycyclic Aromatic Hydrocarbons**	
endosulfan I	< 0.1	naphthalene	< 1
endosulfan II	< 0.1	acenaphthylene	< 0.1
Endosulfan sulfate	< 0.1	acenaphthene	< 0.1
endrin	< 0.1	fluorene	< 0.1
Endrin aldehyde	< 0.1	phenanthrene	< 0.1
Endrin ketone	< 0.1	anthracene	< 0.1
Organonitrogen Herbicides		fluoranthene	< 0.2
Trifluralin	< 0.2	pyrene	< 0.2
Simazine	< 0.1	benz[a]anthracene	< 0.1
Atrazine	< 0.1	chrysene	< 0.1
Terbuthylazine	< 0.2	benzo[b]fluoranthene	< 0.1
Propanil	< 0.1	benzo[k]fluoranthene	< 0.1
Alachlor	< 0.2	benzo[a]pyrene	< 0.1
Metolachlor	< 0.1	indeno[1,2,3-c,d]pyrene	< 0.2
Pendimethalin	< 0.2	dibenz[a,h]anthracene	< 0.2
Molinate	< 0.1	benzo[g,h,i]perylene	< 0.2
Propazine	< 0.1		
Hexazinone	< 0.1		
Metalaxyl	< 0.1		
Cyanazine	< 0.1		
Oxadiazon	< 0.1		
Metribuzin	< 0.1		
Bromacil	< 0.4		
Oryzalin	< 10		

¥ = Results are calculated using the average weight of samples in this batch.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JR Authorised: Jayanthi Ranasinghe

AsureQuality

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P.O. Box 31 242, Lower Hutt
Wellington, New Zealand

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Certificate of Analysis

Date Issued:	17 Aug 2009
Client:	Pattle Delamore Partners Ltd P O Box 6136 Wellington
Attention:	Rod Lidgard
Date Received:	20 Jul 2009
AsureQuality Lab. Reference:	58715
Sample Type(s):	Soil
Analysis:	**TCDD Screen**
Method:	Based on USEPA Method 1613B (Isotope Dilution)

Results are reported in picograms per gram (pg/g), equivalent to ppt, on a dry weight basis to three significant figures. The DL value is reported to three significant figures.

Unless requested, original samples will be disposed of eight weeks from the date of this report.

Comments:

Phil Bridgen
Team Leader - Dioxins
AsureQuality Limited

17 August 2009

Results: 2378 TCDF and 2378 TCDD

Laboratory Reference: **58715-1**

Sample Identification: **1A3/1; B4/1; C2/1;D3/1;E2/1;F6/1- Composite 1**

Date Received: 20 Jul 2009 Date Analysed: 31 Jul 2009

Date Extracted: 27 Jul 2009

Analyte	Conc.¥ (pg/g)	DL	EMPC	^{13}C%RE	LCL-UCL	Qualifiers
2378 TCDF	ND	0.3		98	24 - 169	
2378 TCDD	0.23			106	25 - 164	
37Cl4 TCDD				104	35 - 197	

¥ = Results are reported on a dry weight basis

ND = Not Detected

DL: Sample Specific Estimated Detection Limit

EMPC: Estimated Maximum Possible Concentration

^{13}C %RE: Labelled Compound Recovery

LCL-UCL: Lower Control Limit - Upper Control Limit

Lab Analyst: ML Data Analyst: NE Authorised: Phil Bridgen

17 August 2009

Results: 2378 TCDF and 2378 TCDD

Laboratory Reference: **58715-2**

Sample Identification: **2A11/1; B5/1; C1/1; D6/1; E3/1; F3/1 - Composite 2**

Date Received: 20 Jul 2009 Date Analysed: 31 Jul 2009

Date Extracted: 27 Jul 2009

Analyte	Conc.¥ (pg/g)	DL	EMPC	^{13}C%RE	LCL-UCL	Qualifiers
2378 TCDF	0.32			91	24 - 169	
2378 TCDD	0.27			96	25 - 164	
37Cl4 TCDD				95	35 - 197	

¥ = Results are reported on a dry weight basis

DL: Sample Specific Estimated Detection Limit
EMPC: Estimated Maximum Possible Concentration
^{13}C %RE: Labelled Compound Recovery
LCL-UCL: Lower Control Limit - Upper Control Limit

Lab Analyst: ML Data Analyst: NE Authorised: Phil Bridgen

17 August 2009

Results: 2378 TCDF and 2378 TCDD

Laboratory Reference: **58715-3**

Sample Identification: **3A1/1; B3/1; C6/1; D1/1; E4/1; F5/1 - Composite 3**

Date Received: 20 Jul 2009 Date Analysed: 31 Jul 2009

Date Extracted: 27 Jul 2009

Analyte	Conc.¥ (pg/g)	DL	EMPC	^{13}C%RE	LCL-UCL	Qualifiers
2378 TCDF	0.36			96	24 - 169	
2378 TCDD	0.31			100	25 - 164	
37Cl4 TCDD				96	35 - 197	

¥ = Results are reported on a dry weight basis

DL: Sample Specific Estimated Detection Limit
EMPC: Estimated Maximum Possible Concentration
^{13}C %RE: Labelled Compound Recovery
LCL-UCL: Lower Control Limit - Upper Control Limit

Lab Analyst: ML Data Analyst: NE Authorised: Phil Bridgen

17 August 2009

Results: 2378 TCDF and 2378 TCDD

Laboratory Reference: **58715-4**

Sample Identification: **4A6/1; B2/1; C4/1; D2/1; E5/1; F8/1 - Composite 4**

Date Received: 20 Jul 2009 Date Analysed: 03 Aug 2009

Date Extracted: 27 Jul 2009

Analyte	Conc.¥ (pg/g)	DL	EMPC	^{13}C%RE	LCL-UCL	Qualifiers
2378 TCDF	0.34			92	24 - 169	
2378 TCDD	0.23			97	25 - 164	
37Cl4 TCDD				91	35 - 197	

¥ = Results are reported on a dry weight basis

DL: Sample Specific Estimated Detection Limit
EMPC: Estimated Maximum Possible Concentration
^{13}C %RE: Labelled Compound Recovery
LCL-UCL: Lower Control Limit - Upper Control Limit

Lab Analyst: ML Data Analyst: NE Authorised: Phil Bridgen

17 August 2009

Results: 2378 TCDF and 2378 TCDD

Laboratory Reference: **58715-5**

Sample Identification: **5A3/2; B4/2; C2/2; D3/2; E2/2; F6/2 - Composite 5**

Date Received: 20 Jul 2009 Date Analysed: 31 Jul 2009

Date Extracted: 27 Jul 2009

Analyte	Conc.¥ (pg/g)	DL	EMPC	^{13}C%RE	LCL-UCL	Qualifiers
2378 TCDF	0.37			90	24 - 169	
2378 TCDD	1.4			99	25 - 164	
37Cl4 TCDD				94	35 - 197	

¥ = Results are reported on a dry weight basis

DL: Sample Specific Estimated Detection Limit
EMPC: Estimated Maximum Possible Concentration
^{13}C %RE: Labelled Compound Recovery
LCL-UCL: Lower Control Limit - Upper Control Limit

Lab Analyst: ML Data Analyst: NE Authorised: Phil Bridgen

17 August 2009

Results: 2378 TCDF and 2378 TCDD

Laboratory Reference: **58715-6**

Sample Identification: **6A11/2; B5/2; C1/2; D6/2; E3/2; F3/2 - Composite 6**

Date Received: 20 Jul 2009 Date Analysed: 31 Jul 2009

Date Extracted: 27 Jul 2009

Analyte	Conc.¥ (pg/g)	DL	EMPC	^{13}C%RE	LCL-UCL	Qualifiers
2378 TCDF	0.59			92	24 - 169	
2378 TCDD	1.7			102	25 - 164	
37Cl4 TCDD				96	35 - 197	

¥ = Results are reported on a dry weight basis

DL: Sample Specific Estimated Detection Limit
EMPC: Estimated Maximum Possible Concentration
^{13}C %RE: Labelled Compound Recovery
LCL-UCL: Lower Control Limit - Upper Control Limit

Lab Analyst: ML Data Analyst: NE Authorised: Phil Bridgen

17 August 2009

Results: 2378 TCDF and 2378 TCDD

Laboratory Reference: **58715-7**

Sample Identification: **7A1/2; B3/2; C6/2; D1/2; E4/2; F5/2 - Composite 7**

Date Received: 20 Jul 2009 Date Analysed: 31 Jul 2009

Date Extracted: 27 Jul 2009

Analyte	Conc.¥ (pg/g)	DL	EMPC	^{13}C%RE	LCL-UCL	Qualifiers
2378 TCDF	0.36			93	24 - 169	
2378 TCDD	1.5			99	25 - 164	
37Cl4 TCDD				90	35 - 197	

¥ = Results are reported on a dry weight basis

DL: Sample Specific Estimated Detection Limit
EMPC: Estimated Maximum Possible Concentration
^{13}C %RE: Labelled Compound Recovery
LCL-UCL: Lower Control Limit - Upper Control Limit

Lab Analyst: ML Data Analyst: NE Authorised: Phil Bridgen

17 August 2009

Results: 2378 TCDF and 2378 TCDD

Laboratory Reference: **58715-8**

Sample Identification: **8A6/2; B2/2; C4/2; D2/2; E5/2; F8/2 - Composite 8**

Date Received: 20 Jul 2009 Date Analysed: 31 Jul 2009

Date Extracted: 27 Jul 2009

Analyte	Conc.¥ (pg/g)	DL	EMPC	^{13}C%RE	LCL-UCL	Qualifiers
2378 TCDF	0.68			88	24 - 169	
2378 TCDD	2.3			102	25 - 164	
37Cl4 TCDD				96	35 - 197	

¥ = Results are reported on a dry weight basis

DL: Sample Specific Estimated Detection Limit
EMPC: Estimated Maximum Possible Concentration
^{13}C %RE: Labelled Compound Recovery
LCL-UCL: Lower Control Limit - Upper Control Limit

Lab Analyst: ML Data Analyst: NE Authorised: Phil Bridgen

17 August 2009

Results: 2378 TCDF and 2378 TCDD

Laboratory Reference: **58715-9**

Sample Identification: **9SS1 - SS6 - Composite 9**

Date Received: 20 Jul 2009 Date Analysed: 31 Jul 2009

Date Extracted: 27 Jul 2009

Analyte	Conc.¥ (pg/g)	DL	EMPC	^{13}C%RE	LCL-UCL	Qualifiers
2378 TCDF	ND	0.2		88	24 - 169	
2378 TCDD	ND	0.3		99	25 - 164	
37Cl4 TCDD				95	35 - 197	

¥ = Results are reported on a dry weight basis

ND = Not Detected

DL: Sample Specific Estimated Detection Limit

EMPC: Estimated Maximum Possible Concentration

^{13}C %RE: Labelled Compound Recovery

LCL-UCL: Lower Control Limit - Upper Control Limit

Lab Analyst: ML Data Analyst: NE Authorised: Phil Bridgen

17 August 2009

Results: 2378 TCDF and 2378 TCDD

Laboratory Reference: **58715-10**

Sample Identification: **10SS7 -SS12 - Composite 10**

Date Received: 20 Jul 2009 Date Analysed: 31 Jul 2009

Date Extracted: 27 Jul 2009

Analyte	Conc.¥ (pg/g)	DL	EMPC	^{13}C%RE	LCL-UCL	Qualifiers
2378 TCDF	ND	0.2		86	24 - 169	
2378 TCDD	39			96	25 - 164	
37Cl4 TCDD				93	35 - 197	

¥ = Results are reported on a dry weight basis

ND = Not Detected

DL: Sample Specific Estimated Detection Limit

EMPC: Estimated Maximum Possible Concentration

^{13}C %RE: Labelled Compound Recovery

LCL-UCL: Lower Control Limit - Upper Control Limit

Lab Analyst: ML Data Analyst: NE Authorised: Phil Bridgen

17 August 2009

Results: 2378 TCDF and 2378 TCDD

Laboratory Reference: **58715-11**

Sample Identification: **11SS13/1-SS18/1 - Composite 11**

Date Received: 20 Jul 2009 Date Analysed: 31 Jul 2009

Date Extracted: 27 Jul 2009

Analyte	Conc.¥ (pg/g)	DL	EMPC	^{13}C%RE	LCL-UCL	Qualifiers
2378 TCDF	ND	0.2		85	24 - 169	
2378 TCDD	0.95			97	25 - 164	
37Cl4 TCDD				95	35 - 197	

¥ = Results are reported on a dry weight basis
ND = Not Detected
DL: Sample Specific Estimated Detection Limit
EMPC: Estimated Maximum Possible Concentration
^{13}C %RE: Labelled Compound Recovery
LCL-UCL: Lower Control Limit - Upper Control Limit

Lab Analyst: ML Data Analyst: NE Authorised: Phil Bridgen

17 August 2009

Results: 2378 TCDF and 2378 TCDD

Laboratory Reference: **58715-12**

Sample Identification: **12SS19 - SS24 - Composite 12**

Date Received: 20 Jul 2009 Date Analysed: 31 Jul 2009

Date Extracted: 27 Jul 2009

Analyte	Conc.¥ (pg/g)	DL	EMPC	^{13}C%RE	LCL-UCL	Qualifiers
2378 TCDF	ND	0.1		87	24 - 169	
2378 TCDD	0.37			98	25 - 164	
37Cl4 TCDD				91	35 - 197	

¥ = Results are reported on a dry weight basis

ND = Not Detected

DL: Sample Specific Estimated Detection Limit

EMPC: Estimated Maximum Possible Concentration

^{13}C %RE: Labelled Compound Recovery

LCL-UCL: Lower Control Limit - Upper Control Limit

Lab Analyst: ML Data Analyst: NE Authorised: Phil Bridgen

17 August 2009

Results: 2378 TCDF and 2378 TCDD

Laboratory Reference: **58715-13**

Sample Identification: **13SS25 - SS31 - Composite 13**

Date Received: 20 Jul 2009 Date Analysed: 31 Jul 2009

Date Extracted: 27 Jul 2009

Analyte	Conc.¥ (pg/g)	DL	EMPC	^{13}C%RE	LCL-UCL	Qualifiers
2378 TCDF	ND	0.2		84	24 - 169	
2378 TCDD	0.45			95	25 - 164	
37Cl4 TCDD				89	35 - 197	

¥ = Results are reported on a dry weight basis

ND = Not Detected

DL: Sample Specific Estimated Detection Limit

EMPC: Estimated Maximum Possible Concentration

^{13}C %RE: Labelled Compound Recovery

LCL-UCL: Lower Control Limit - Upper Control Limit

Lab Analyst: ML Data Analyst: NE Authorised: Phil Bridgen

17 August 2009

Results: 2378 TCDF and 2378 TCDD

Laboratory Reference: **58715-14**

Sample Identification: **14 SS13/2 - SS 18/2, Composite 14**

Date Received: 20 Jul 2009 Date Analysed: 31 Jul 2009

Date Extracted: 27 Jul 2009

Analyte	Conc.¥ (pg/g)	DL	EMPC	^{13}C%RE	LCL-UCL	Qualifiers
2378 TCDF	0.72			93	24 - 169	
2378 TCDD	3.0			100	25 - 164	
37Cl4 TCDD				94	35 - 197	

¥ = Results are reported on a dry weight basis

DL: Sample Specific Estimated Detection Limit
EMPC: Estimated Maximum Possible Concentration
^{13}C %RE: Labelled Compound Recovery
LCL-UCL: Lower Control Limit - Upper Control Limit

Lab Analyst: ML Data Analyst: NE Authorised: Phil Bridgen

17 August 2009

Results: 2378 TCDF and 2378 TCDD

Laboratory Reference: **58715/BLANK-A**

Sample Identification: **Laboratory Blank**

Date Received: Not applicable

Date Analysed: 31 Jul 2009

Date Extracted: 27 Jul 2009

Analyte	Conc.¥ (pg/g)	DL	EMPC	^{13}C%RE	LCL-UCL	Qualifiers
2378 TCDF	ND	0.2		114	24 - 169	
2378 TCDD	ND	0.3		99	25 - 164	
37Cl4 TCDD				98	35 - 197	

¥ = Results are calculated using the average weight of samples in this batch

ND = Not Detected

DL: Sample Specific Estimated Detection Limit

EMPC: Estimated Maximum Possible Concentration

^{13}C %RE: Labelled Compound Recovery

LCL-UCL: Lower Control Limit - Upper Control Limit

Lab Analyst: MC Data Analyst: NE Authorised: Phil Bridgen

AsureQuality

1C Quadrant Drive, Gracefield
P.O. Box 31 242, Lower Hutt
Wellington, New Zealand

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Certificate of Analysis

Date Issued:	17 Aug 2009
Client:	Pattle Delamore Partners Ltd P O Box 6136 Wellington
Attention:	Rod Lidgard
Date Received:	20 Jul 2009
AsureQuality Lab. Reference:	58715
Sample Type(s):	Soil
Analysis:	**Multiresidue - Soil**
Method:	FSO-02

The sample was extracted and further purified using gel permeation chromatography. Measurement was performed using gas chromatography - mass spectrometry.

Results are reported to two significant figures in milligrams per kilogram (mg/kg), equivalent to ppm, on a dry weight basis. Detection limits are reported to one significant figure and may depend on the nature of the matrix.

Unless requested, original samples will be disposed of eight weeks from the date of this report.

Comments:

Koos Hoogenboom
Senior Scientist - Pesticides
AsureQuality Limited

ilac-MRA 131 laboratory

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-1
Sample Identification: 1A3/1; B4/1; C2/1;D3/1;E2/1;F6/1- Composit

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Acetochlor	ND	0.01
Alachlor	ND	0.01
Aldrin	ND	0.01
Atrazine	ND	0.01
Azaconazole	ND	0.01
Azinphos-methyl	ND	0.1
Azoxystrobin	ND	0.01
Benalaxyl	ND	0.01
Bendiocarb	ND	0.01
Benodanil	ND	0.01
BHC (alpha)	ND	0.01
BHC (beta)	ND	0.01
BHC (delta)	ND	0.01
Bifenthrin	ND	0.01
Binapacryl	ND	0.01
Bitertanol	ND	0.01
Bromacil	ND	0.01
Bromophos-ethyl	ND	0.01
Bromophos	ND	0.01
Bromopropylate	ND	0.01
Bupirimate	ND	0.01
Buprofezin	ND	0.01
Captan	ND	0.01
Carbaryl	ND	0.01
Carbofuran	ND	0.01
Carboxin	ND	0.01
Chlordane (cis)	ND	0.01
Chlordane (trans)	ND	0.01
Chlorfenvinphos	ND	0.01
Chlorobenzilate	ND	0.01
Chlorothalonil	ND	0.01
Chlorpropham	ND	0.01
Chlorpyrifos	ND	0.01
Chlorthal-dimethyl	ND	0.01
Chlozolinate	ND	0.01
Chlorpyrifos-methyl	ND	0.01
Clomazone	ND	0.01
Coumafos	ND	0.01
Cyanazine	ND	0.01
Cyfluthrin	ND	0.02
Cyhalothrin	ND	0.01
Cypermethrin	ND	0.03
Cyproconazole	ND	0.01
Cyprodinil	ND	0.01
DDD (o,p')	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH
Data Analyst: SP
Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-1
Sample Identification: 1A3/1; B4/1; C2/1;D3/1;E2/1;F6/1- Composit

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
DDD (p,p')	ND	0.01
DDE (o,p')	ND	0.01
DDE (p,p')	ND	0.01
DDT (o,p')	ND	0.01
DDT (p,p')	ND	0.01
Deltamethrin	ND	0.01
Demeton-s-methyl	ND	0.01
Diazinon	ND	0.01
Dichlobenil	ND	0.01
Dichlofenthion	ND	0.01
Dichlofluanid	ND	0.01
Dichlorvos	ND	0.01
Dichloran	ND	0.01
Dicofol	ND	0.01
Dicrotophos	ND	0.01
Dieldrin	ND	0.01
Diflufenican	ND	0.01
Difenoconazole	ND	0.01
Dimethoate	ND	0.01
Dimethomorph	ND	0.01
Dimethenamid	ND	0.01
Diphenamid	ND	0.01
Diphenylamine	ND	0.01
Disulfoton	ND	0.01
Endosulfan (alpha)	ND	0.01
Endosulfan (beta)	ND	0.01
Endosulfan sulphate	ND	0.01
Endrin	ND	0.01
EPN	ND	0.01
Epoxiconazole	ND	0.01
EPTC	ND	0.01
Ethiofencarb	ND	0.01
Ethion	ND	0.01
Ethoprofos	ND	0.01
Ethoxyquin	ND	0.01
Etridiazole	ND	0.01
Etrimfos	ND	0.01
Famphur	ND	0.01
Fenamiphos	ND	0.01
Fenarimol	ND	0.01
Fenchlorphos	ND	0.01
Fenitrothion	ND	0.01
Fenpiclonil	ND	0.01
Fenpropimorph	ND	0.01
Fenpropathrin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-1
Sample Identification: 1A3/1; B4/1; C2/1;D3/1;E2/1;F6/1- Composit

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Fensulfothion	ND	0.01
Fenthion	ND	0.01
Fenvalerate	ND	0.01
Fenoxaprop-ethyl	ND	0.01
Fenoxycarb	ND	0.02
Fipronil	ND	0.01
Flamprop-methyl	ND	0.01
Fluazinam	ND	0.1
Fluazifop-p-butyl	ND	0.01
Fludioxonil	ND	0.01
Flusilazole	ND	0.01
Flutriafol	ND	0.01
Fluvalinate	ND	0.02
Folpet	ND	0.02
Furalaxyl	ND	0.01
Furathiocarb	ND	0.01
Haloxyfop-etotyl	ND	0.01
Haloxyfop-methyl	ND	0.01
Hexachlorobenzene	ND	0.01
Heptachlor	ND	0.01
Heptachlor-epoxide	ND	0.01
Heptenophos	ND	0.01
Hexaconazole	ND	0.01
Hexazinone	ND	0.01
Indoxacarb	ND	0.01
Iodofenphos	ND	0.01
Iprodione	ND	0.01
Isofenphos	ND	0.01
Kresoxim-methyl	ND	0.01
Lindane	ND	0.01
Linuron	ND	0.01
Malathion	ND	0.01
Metalaxyl	ND	0.01
Methacrifos	ND	0.01
Methiocarb	ND	0.01
Methidathion	ND	0.01
Metolachlor	ND	0.01
Metribuzin	ND	0.01
Mevinphos	ND	0.01
Monocrotophos	ND	0.01
Myclobutanil	ND	0.01
Napropamide	ND	0.01
Nitrofen	ND	0.01
Nitrothal-isopropyl	ND	0.01
Norflurazon	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-1
Sample Identification: 1A3/1; B4/1; C2/1;D3/1;E2/1;F6/1- Composit

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Omethoate	ND	0.1
Oxadiazon	ND	0.01
Oxyfluorfen	ND	0.01
Paclobutrazol	ND	0.01
Parathion-methyl	ND	0.01
Parathion	ND	0.01
Penconazole	ND	0.01
Pendimethalin	ND	0.01
Permethrin	ND	0.01
Phorate	ND	0.01
Phorate sulphone	ND	0.05
Phorate sulphoxide	ND	0.05
Phosalone	ND	0.01
Phosmet	ND	0.01
Phosphamidon	ND	0.01
Piperonyl butoxide	ND	0.01
Pirimicarb	ND	0.01
Pirimiphos-methyl	ND	0.01
Prochloraz	ND	0.05
Procymidone	ND	0.01
Prometryn	ND	0.01
Propachlor	ND	0.01
Propargite	ND	0.01
Propazine	ND	0.01
Propetamphos	ND	0.01
Propham	ND	0.01
Propiconazole	ND	0.01
Propoxur	ND	0.01
Propyzamide	ND	0.01
Prothiofos	ND	0.01
Pyrazophos	ND	0.01
Pyrimethanil	ND	0.01
Pyriproxyfen	ND	0.01
Quintozene	ND	0.01
Quinalphos	ND	0.01
Quizalofop-ethyl	ND	0.01
Simazine	ND	0.01
Tebuconazole	ND	0.01
Tebufenpyrad	ND	0.01
Terbacil	ND	0.01
Terbufos	ND	0.01
Terbumeton	ND	0.01
Terbutylazine	ND	0.01
Terbutryn	ND	0.01
Tetrachlorvinphos	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-1
Sample Identification: 1A3/1; B4/1; C2/1;D3/1;E2/1;F6/1- Composit

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Tetradifon	ND	0.01
Tolclofos-methyl	ND	0.01
Tolylfluanid	ND	0.01
Tralkoxydim	ND	0.01
Triadimefon	ND	0.01
Triadimenol	ND	0.01
Triallate	ND	0.01
Triazophos	ND	0.01
Trifloxystrobin	ND	0.01
Trifluralin	ND	0.01
Vinclozolin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-2
Sample Identification: 2A11/1; B5/1; C1/1; D6/1; E3/1; F3/1 - Comp

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Acetochlor	ND	0.01
Alachlor	ND	0.01
Aldrin	ND	0.01
Atrazine	ND	0.01
Azaconazole	ND	0.01
Azinphos-methyl	ND	0.1
Azoxystrobin	ND	0.01
Benalaxyl	ND	0.01
Bendiocarb	ND	0.01
Benodanil	ND	0.01
BHC (alpha)	ND	0.01
BHC (beta)	ND	0.01
BHC (delta)	ND	0.01
Bifenthrin	ND	0.01
Binapacryl	ND	0.01
Bitertanol	ND	0.01
Bromacil	ND	0.01
Bromophos-ethyl	ND	0.01
Bromophos	ND	0.01
Bromopropylate	ND	0.01
Bupirimate	ND	0.01
Buprofezin	ND	0.01
Captan	ND	0.01
Carbaryl	ND	0.01
Carbofuran	ND	0.01
Carboxin	ND	0.01
Chlordane (cis)	ND	0.01
Chlordane (trans)	ND	0.01
Chlorfenvinphos	ND	0.01
Chlorobenzilate	ND	0.01
Chlorothalonil	ND	0.01
Chlorpropham	ND	0.01
Chlorpyrifos	ND	0.01
Chlorthal-dimethyl	ND	0.01
Chlozolinate	ND	0.01
Chlorpyrifos-methyl	ND	0.01
Clomazone	ND	0.01
Coumafos	ND	0.01
Cyanazine	ND	0.01
Cyfluthrin	ND	0.02
Cyhalothrin	ND	0.01
Cypermethrin	ND	0.03
Cyproconazole	ND	0.01
Cyprodinil	ND	0.01
DDD (o,p')	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH
Data Analyst: SP
Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-2
Sample Identification: 2A11/1; B5/1; C1/1; D6/1; E3/1; F3/1 - Comp

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
DDD (p,p')	ND	0.01
DDE (o,p')	ND	0.01
DDE (p,p')	ND	0.01
DDT (o,p')	ND	0.01
DDT (p,p')	ND	0.01
Deltamethrin	ND	0.01
Demeton-s-methyl	ND	0.01
Diazinon	ND	0.01
Dichlobenil	ND	0.01
Dichlofenthion	ND	0.01
Dichlofluanid	ND	0.01
Dichlorvos	ND	0.01
Dichloran	ND	0.01
Dicofol	ND	0.01
Dicrotophos	ND	0.01
Dieldrin	ND	0.01
Diflufenican	ND	0.01
Difenoconazole	ND	0.01
Dimethoate	ND	0.01
Dimethomorph	ND	0.01
Dimethenamid	ND	0.01
Diphenamid	ND	0.01
Diphenylamine	ND	0.01
Disulfoton	ND	0.01
Endosulfan (alpha)	ND	0.01
Endosulfan (beta)	ND	0.01
Endosulfan sulphate	ND	0.01
Endrin	ND	0.01
EPN	ND	0.01
Epoxiconazole	ND	0.01
EPTC	ND	0.01
Ethiofencarb	ND	0.01
Ethion	ND	0.01
Ethoprofos	ND	0.01
Ethoxyquin	ND	0.01
Etridiazole	ND	0.01
Etrimfos	ND	0.01
Famphur	ND	0.01
Fenamiphos	ND	0.01
Fenarimol	ND	0.01
Fenchlorphos	ND	0.01
Fenitrothion	ND	0.01
Fenpiclonil	ND	0.01
Fenpropimorph	ND	0.01
Fenpropathrin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-2
Sample Identification: 2A11/1; B5/1; C1/1; D6/1; E3/1; F3/1 - Comp

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Fensulfothion	ND	0.01
Fenthion	ND	0.01
Fenvalerate	ND	0.01
Fenoxaprop-ethyl	ND	0.01
Fenoxycarb	ND	0.02
Fipronil	ND	0.01
Flamprop-methyl	ND	0.01
Fluazinam	ND	0.1
Fluazifop-p-butyl	ND	0.01
Fludioxonil	ND	0.01
Flusilazole	ND	0.01
Flutriafol	ND	0.01
Fluvalinate	ND	0.02
Folpet	ND	0.02
Furalaxyl	ND	0.01
Furathiocarb	ND	0.01
Haloxyfop-etotyl	ND	0.01
Haloxyfop-methyl	ND	0.01
Hexachlorobenzene	ND	0.01
Heptachlor	ND	0.01
Heptachlor-epoxide	ND	0.01
Heptenophos	ND	0.01
Hexaconazole	ND	0.01
Hexazinone	ND	0.01
Indoxacarb	ND	0.01
Iodofenphos	ND	0.01
Iprodione	ND	0.01
Isofenphos	ND	0.01
Kresoxim-methyl	ND	0.01
Lindane	ND	0.01
Linuron	ND	0.01
Malathion	ND	0.01
Metalaxyl	ND	0.01
Methacrifos	ND	0.01
Methiocarb	ND	0.01
Methidathion	ND	0.01
Metolachlor	ND	0.01
Metribuzin	ND	0.01
Mevinphos	ND	0.01
Monocrotophos	ND	0.01
Myclobutanil	ND	0.01
Napropamide	ND	0.01
Nitrofen	ND	0.01
Nitrothal-isopropyl	ND	0.01
Norflurazon	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-2
Sample Identification: 2A11/1; B5/1; C1/1; D6/1; E3/1; F3/1 - Comp

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Omethoate	ND	0.1
Oxadiazon	ND	0.01
Oxyfluorfen	ND	0.01
Paclobutrazol	ND	0.01
Parathion-methyl	ND	0.01
Parathion	ND	0.01
Penconazole	ND	0.01
Pendimethalin	ND	0.01
Permethrin	ND	0.01
Phorate	ND	0.01
Phorate sulphone	ND	0.05
Phorate sulphoxide	ND	0.05
Phosalone	ND	0.01
Phosmet	ND	0.01
Phosphamidon	ND	0.01
Piperonyl butoxide	ND	0.01
Pirimicarb	ND	0.01
Pirimiphos-methyl	ND	0.01
Prochloraz	ND	0.05
Procymidone	ND	0.01
Prometryn	ND	0.01
Propachlor	ND	0.01
Propargite	ND	0.01
Propazine	ND	0.01
Propetamphos	ND	0.01
Propham	ND	0.01
Propiconazole	ND	0.01
Propoxur	ND	0.01
Propyzamide	ND	0.01
Prothiofos	ND	0.01
Pyrazophos	ND	0.01
Pyrimethanil	ND	0.01
Pyriproxyfen	ND	0.01
Quintozene	ND	0.01
Quinalphos	ND	0.01
Quizalofop-ethyl	ND	0.01
Simazine	ND	0.01
Tebuconazole	ND	0.01
Tebufenpyrad	ND	0.01
Terbacil	ND	0.01
Terbufos	ND	0.01
Terbumeton	ND	0.01
Terbutylazine	ND	0.01
Terbutryn	ND	0.01
Tetrachlorvinphos	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-2
Sample Identification: 2A11/1; B5/1; C1/1; D6/1; E3/1; F3/1 - Comp

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Tetradifon	ND	0.01
Tolclofos-methyl	ND	0.01
Tolylfluanid	ND	0.01
Tralkoxydim	ND	0.01
Triadimefon	ND	0.01
Triadimenol	ND	0.01
Triallate	ND	0.01
Triazophos	ND	0.01
Trifloxystrobin	ND	0.01
Trifluralin	ND	0.01
Vinclozolin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

Results: Pesticides in Soil

Laboratory Reference: 58715-3
Sample Identification: 3A1/1; B3/1; C6/1; D1/1; E4/1; F5/1 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Acetochlor	ND	0.01
Alachlor	ND	0.01
Aldrin	ND	0.01
Atrazine	ND	0.01
Azaconazole	ND	0.01
Azinphos-methyl	ND	0.1
Azoxystrobin	ND	0.01
Benalaxyl	ND	0.01
Bendiocarb	ND	0.01
Benodanil	ND	0.01
BHC (alpha)	ND	0.01
BHC (beta)	ND	0.01
BHC (delta)	ND	0.01
Bifenthrin	ND	0.01
Binapacryl	ND	0.01
Bitertanol	ND	0.01
Bromacil	ND	0.01
Bromophos-ethyl	ND	0.01
Bromophos	ND	0.01
Bromopropylate	ND	0.01
Bupirimate	ND	0.01
Buprofezin	ND	0.01
Captan	ND	0.01
Carbaryl	ND	0.01
Carbofuran	ND	0.01
Carboxin	ND	0.01
Chlordane (cis)	ND	0.01
Chlordane (trans)	ND	0.01
Chlorfenvinphos	ND	0.01
Chlorobenzilate	ND	0.01
Chlorothalonil	ND	0.01
Chlorpropham	ND	0.01
Chlorpyrifos	ND	0.01
Chlorthal-dimethyl	ND	0.01
Chlozolinate	ND	0.01
Chlorpyrifos-methyl	ND	0.01
Clomazone	ND	0.01
Coumafos	ND	0.01
Cyanazine	ND	0.01
Cyfluthrin	ND	0.02
Cyhalothrin	ND	0.01
Cypermethrin	ND	0.03
Cyproconazole	ND	0.01
Cyprodinil	ND	0.01
DDD (o,p')	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH
Data Analyst: SP
Authorised: Koos Hoogenboom

Results: Pesticides in Soil

Laboratory Reference: 58715-3
Sample Identification: 3A1/1; B3/1; C6/1; D1/1; E4/1; F5/1 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
DDD (p,p')	ND	0.01
DDE (o,p')	ND	0.01
DDE (p,p')	ND	0.01
DDT (o,p')	ND	0.01
DDT (p,p')	ND	0.01
Deltamethrin	ND	0.01
Demeton-s-methyl	ND	0.01
Diazinon	ND	0.01
Dichlobenil	ND	0.01
Dichlofenthion	ND	0.01
Dichlofluanid	ND	0.01
Dichlorvos	ND	0.01
Dichloran	ND	0.01
Dicofol	ND	0.01
Dicrotophos	ND	0.01
Dieldrin	ND	0.01
Diflufenican	ND	0.01
Difenoconazole	ND	0.01
Dimethoate	ND	0.01
Dimethomorph	ND	0.01
Dimethenamid	ND	0.01
Diphenamid	ND	0.01
Diphenylamine	ND	0.01
Disulfoton	ND	0.01
Endosulfan (alpha)	ND	0.01
Endosulfan (beta)	ND	0.01
Endosulfan sulphate	ND	0.01
Endrin	ND	0.01
EPN	ND	0.01
Epoxiconazole	ND	0.01
EPTC	ND	0.01
Ethiofencarb	ND	0.01
Ethion	ND	0.01
Ethoprofos	ND	0.01
Ethoxyquin	ND	0.01
Etridiazole	ND	0.01
Etrimfos	ND	0.01
Famphur	ND	0.01
Fenamiphos	ND	0.01
Fenarimol	ND	0.01
Fenchlorphos	ND	0.01
Fenitrothion	ND	0.01
Fenpiclonil	ND	0.01
Fenpropimorph	ND	0.01
Fenpropathrin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

Results: Pesticides in Soil

Laboratory Reference: 58715-3
Sample Identification: 3A1/1; B3/1; C6/1; D1/1; E4/1; F5/1 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Fensulfothion	ND	0.01
Fenthion	ND	0.01
Fenvalerate	ND	0.01
Fenoxaprop-ethyl	ND	0.01
Fenoxycarb	ND	0.02
Fipronil	ND	0.01
Flamprop-methyl	ND	0.01
Fluazinam	ND	0.1
Fluazifop-p-butyl	ND	0.01
Fludioxonil	ND	0.01
Flusilazole	ND	0.01
Flutriafol	ND	0.01
Fluvalinate	ND	0.02
Folpet	ND	0.02
Furalaxyl	ND	0.01
Furathiocarb	ND	0.01
Haloxyfop-etotyl	ND	0.01
Haloxyfop-methyl	ND	0.01
Hexachlorobenzene	ND	0.01
Heptachlor	ND	0.01
Heptachlor-epoxide	ND	0.01
Heptenophos	ND	0.01
Hexaconazole	ND	0.01
Hexazinone	ND	0.01
Indoxacarb	ND	0.01
Iodofenphos	ND	0.01
Iprodione	ND	0.01
Isofenphos	ND	0.01
Kresoxim-methyl	ND	0.01
Lindane	ND	0.01
Linuron	ND	0.01
Malathion	ND	0.01
Metalaxyl	ND	0.01
Methacrifos	ND	0.01
Methiocarb	ND	0.01
Methidathion	ND	0.01
Metolachlor	ND	0.01
Metribuzin	ND	0.01
Mevinphos	ND	0.01
Monocrotophos	ND	0.01
Myclobutanil	ND	0.01
Napropamide	ND	0.01
Nitrofen	ND	0.01
Nitrothal-isopropyl	ND	0.01
Norflurazon	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

Results: Pesticides in Soil

Laboratory Reference: 58715-3
Sample Identification: 3A1/1; B3/1; C6/1; D1/1; E4/1; F5/1 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Omethoate	ND	0.1
Oxadiazon	ND	0.01
Oxyfluorfen	ND	0.01
Paclobutrazol	ND	0.01
Parathion-methyl	ND	0.01
Parathion	ND	0.01
Penconazole	ND	0.01
Pendimethalin	ND	0.01
Permethrin	ND	0.01
Phorate	ND	0.01
Phorate sulphone	ND	0.05
Phorate sulphoxide	ND	0.05
Phosalone	ND	0.01
Phosmet	ND	0.01
Phosphamidon	ND	0.01
Piperonyl butoxide	ND	0.01
Pirimicarb	ND	0.01
Pirimiphos-methyl	ND	0.01
Prochloraz	ND	0.05
Procymidone	ND	0.01
Prometryn	ND	0.01
Propachlor	ND	0.01
Propargite	ND	0.01
Propazine	ND	0.01
Propetamphos	ND	0.01
Propham	ND	0.01
Propiconazole	ND	0.01
Propoxur	ND	0.01
Propyzamide	ND	0.01
Prothiofos	ND	0.01
Pyrazophos	ND	0.01
Pyrimethanil	ND	0.01
Pyriproxyfen	ND	0.01
Quintozene	ND	0.01
Quinalphos	ND	0.01
Quizalofop-ethyl	ND	0.01
Simazine	ND	0.01
Tebuconazole	ND	0.01
Tebufenpyrad	ND	0.01
Terbacil	ND	0.01
Terbufos	ND	0.01
Terbumeton	ND	0.01
Terbutylazine	ND	0.01
Terbutryn	ND	0.01
Tetrachlorvinphos	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-3
Sample Identification: 3A1/1; B3/1; C6/1; D1/1; E4/1; F5/1 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Tetradifon	ND	0.01
Tolclofos-methyl	ND	0.01
Tolylfluanid	ND	0.01
Tralkoxydim	ND	0.01
Triadimefon	ND	0.01
Triadimenol	ND	0.01
Triallate	ND	0.01
Triazophos	ND	0.01
Trifloxystrobin	ND	0.01
Trifluralin	ND	0.01
Vinclozolin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

Results: Pesticides in Soil

Laboratory Reference: 58715-4
Sample Identification: 4A6/1; B2/1; C4/1; D2/1; E5/1; F8/1 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Acetochlor	ND	0.01
Alachlor	ND	0.01
Aldrin	ND	0.01
Atrazine	ND	0.01
Azaconazole	ND	0.01
Azinphos-methyl	ND	0.1
Azoxystrobin	ND	0.01
Benalaxyl	ND	0.01
Bendiocarb	ND	0.01
Benodanil	ND	0.01
BHC (alpha)	ND	0.01
BHC (beta)	ND	0.01
BHC (delta)	ND	0.01
Bifenthrin	ND	0.01
Binapacryl	ND	0.01
Bitertanol	ND	0.01
Bromacil	ND	0.01
Bromophos-ethyl	ND	0.01
Bromophos	ND	0.01
Bromopropylate	ND	0.01
Bupirimate	ND	0.01
Buprofezin	ND	0.01
Captan	ND	0.01
Carbaryl	ND	0.01
Carbofuran	ND	0.01
Carboxin	ND	0.01
Chlordane (cis)	ND	0.01
Chlordane (trans)	ND	0.01
Chlorfenvinphos	ND	0.01
Chlorobenzilate	ND	0.01
Chlorothalonil	ND	0.01
Chlorpropham	ND	0.01
Chlorpyrifos	ND	0.01
Chlorthal-dimethyl	ND	0.01
Chlozolinate	ND	0.01
Chlorpyrifos-methyl	ND	0.01
Clomazone	ND	0.01
Coumafos	ND	0.01
Cyanazine	ND	0.01
Cyfluthrin	ND	0.02
Cyhalothrin	ND	0.01
Cypermethrin	ND	0.03
Cyproconazole	ND	0.01
Cyprodinil	ND	0.01
DDD (o,p')	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH
Data Analyst: SP
Authorised: Koos Hoogenboom

Results: Pesticides in Soil

Laboratory Reference: 58715-4
Sample Identification: 4A6/1; B2/1; C4/1; D2/1; E5/1; F8/1 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
DDD (p,p')	ND	0.01
DDE (o,p')	ND	0.01
DDE (p,p')	ND	0.01
DDT (o,p')	ND	0.01
DDT (p,p')	ND	0.01
Deltamethrin	ND	0.01
Demeton-s-methyl	ND	0.01
Diazinon	ND	0.01
Dichlobenil	ND	0.01
Dichlofenthion	ND	0.01
Dichlofluanid	ND	0.01
Dichlorvos	ND	0.01
Dichloran	ND	0.01
Dicofol	ND	0.01
Dicrotophos	ND	0.01
Dieldrin	ND	0.01
Diflufenican	ND	0.01
Difenoconazole	ND	0.01
Dimethoate	ND	0.01
Dimethomorph	ND	0.01
Dimethenamid	ND	0.01
Diphenamid	ND	0.01
Diphenylamine	ND	0.01
Disulfoton	ND	0.01
Endosulfan (alpha)	ND	0.01
Endosulfan (beta)	ND	0.01
Endosulfan sulphate	ND	0.01
Endrin	ND	0.01
EPN	ND	0.01
Epoxiconazole	ND	0.01
EPTC	ND	0.01
Ethiofencarb	ND	0.01
Ethion	ND	0.01
Ethoprofos	ND	0.01
Ethoxyquin	ND	0.01
Etridiazole	ND	0.01
Etrimfos	ND	0.01
Famphur	ND	0.01
Fenamiphos	ND	0.01
Fenarimol	ND	0.01
Fenchlorphos	ND	0.01
Fenitrothion	ND	0.01
Fenpiclonil	ND	0.01
Fenpropimorph	ND	0.01
Fenpropathrin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

Results: Pesticides in Soil

Laboratory Reference: 58715-4
Sample Identification: 4A6/1; B2/1; C4/1; D2/1; E5/1; F8/1 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Fensulfothion	ND	0.01
Fenthion	ND	0.01
Fenvalerate	ND	0.01
Fenoxaprop-ethyl	ND	0.01
Fenoxycarb	ND	0.02
Fipronil	ND	0.01
Flamprop-methyl	ND	0.01
Fluazinam	ND	0.1
Fluazifop-p-butyl	ND	0.01
Fludioxonil	ND	0.01
Flusilazole	ND	0.01
Flutriafol	ND	0.01
Fluvalinate	ND	0.02
Folpet	ND	0.02
Furalaxyl	ND	0.01
Furathiocarb	ND	0.01
Haloxyfop-etotyl	ND	0.01
Haloxyfop-methyl	ND	0.01
Hexachlorobenzene	ND	0.01
Heptachlor	ND	0.01
Heptachlor-epoxide	ND	0.01
Heptenophos	ND	0.01
Hexaconazole	ND	0.01
Hexazinone	ND	0.01
Indoxacarb	ND	0.01
Iodofenphos	ND	0.01
Iprodione	ND	0.01
Isofenphos	ND	0.01
Kresoxim-methyl	ND	0.01
Lindane	ND	0.01
Linuron	ND	0.01
Malathion	ND	0.01
Metalaxyl	ND	0.01
Methacrifos	ND	0.01
Methiocarb	ND	0.01
Methidathion	ND	0.01
Metolachlor	ND	0.01
Metribuzin	ND	0.01
Mevinphos	ND	0.01
Monocrotophos	ND	0.01
Myclobutanil	ND	0.01
Napropamide	ND	0.01
Nitrofen	ND	0.01
Nitrothal-isopropyl	ND	0.01
Norflurazon	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

Results: Pesticides in Soil

Laboratory Reference: 58715-4
Sample Identification: 4A6/1; B2/1; C4/1; D2/1; E5/1; F8/1 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Omethoate	ND	0.1
Oxadiazon	ND	0.01
Oxyfluorfen	ND	0.01
Paclobutrazol	ND	0.01
Parathion-methyl	ND	0.01
Parathion	ND	0.01
Penconazole	ND	0.01
Pendimethalin	ND	0.01
Permethrin	ND	0.01
Phorate	ND	0.01
Phorate sulphone	ND	0.05
Phorate sulphoxide	ND	0.05
Phosalone	ND	0.01
Phosmet	ND	0.01
Phosphamidon	ND	0.01
Piperonyl butoxide	ND	0.01
Pirimicarb	ND	0.01
Pirimiphos-methyl	ND	0.01
Prochloraz	ND	0.05
Procymidone	ND	0.01
Prometryn	ND	0.01
Propachlor	ND	0.01
Propargite	ND	0.01
Propazine	ND	0.01
Propetamphos	ND	0.01
Propham	ND	0.01
Propiconazole	ND	0.01
Propoxur	ND	0.01
Propyzamide	ND	0.01
Prothiofos	ND	0.01
Pyrazophos	ND	0.01
Pyrimethanil	ND	0.01
Pyriproxyfen	ND	0.01
Quintozene	ND	0.01
Quinalphos	ND	0.01
Quizalofop-ethyl	ND	0.01
Simazine	ND	0.01
Tebuconazole	ND	0.01
Tebufenpyrad	ND	0.01
Terbacil	ND	0.01
Terbufos	ND	0.01
Terbumeton	ND	0.01
Terbutylazine	ND	0.01
Terbutryn	ND	0.01
Tetrachlorvinphos	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-4
Sample Identification: 4A6/1; B2/1; C4/1; D2/1; E5/1; F8/1 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Tetradifon	ND	0.01
Tolclofos-methyl	ND	0.01
Tolylfluanid	ND	0.01
Tralkoxydim	ND	0.01
Triadimefon	ND	0.01
Triadimenol	ND	0.01
Triallate	ND	0.01
Triazophos	ND	0.01
Trifloxystrobin	ND	0.01
Trifluralin	ND	0.01
Vinclozolin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-5
Sample Identification: 5A3/2; B4/2; C2/2; D3/2; E2/2; F6/2 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Acetochlor	ND	0.01
Alachlor	ND	0.01
Aldrin	ND	0.01
Atrazine	ND	0.01
Azaconazole	ND	0.01
Azinphos-methyl	ND	0.1
Azoxystrobin	ND	0.01
Benalaxyl	ND	0.01
Bendiocarb	ND	0.01
Benodanil	ND	0.01
BHC (alpha)	ND	0.01
BHC (beta)	ND	0.01
BHC (delta)	ND	0.01
Bifenthrin	ND	0.01
Binapacryl	ND	0.01
Bitertanol	ND	0.01
Bromacil	ND	0.01
Bromophos-ethyl	ND	0.01
Bromophos	ND	0.01
Bromopropylate	ND	0.01
Bupirimate	ND	0.01
Buprofezin	ND	0.01
Captan	ND	0.01
Carbaryl	ND	0.01
Carbofuran	ND	0.01
Carboxin	ND	0.01
Chlordane (cis)	ND	0.01
Chlordane (trans)	ND	0.01
Chlorfenvinphos	ND	0.01
Chlorobenzilate	ND	0.01
Chlorothalonil	ND	0.01
Chlorpropham	ND	0.01
Chlorpyrifos	ND	0.01
Chlorthal-dimethyl	ND	0.01
Chlozolinate	ND	0.01
Chlorpyrifos-methyl	ND	0.01
Clomazone	ND	0.01
Coumafos	ND	0.01
Cyanazine	ND	0.01
Cyfluthrin	ND	0.02
Cyhalothrin	ND	0.01
Cypermethrin	ND	0.03
Cyproconazole	ND	0.01
Cyprodinil	ND	0.01
DDD (o,p')	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH
Data Analyst: SP
Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-5
Sample Identification: 5A3/2; B4/2; C2/2; D3/2; E2/2; F6/2 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
DDD (p,p')	**0.017**	0.01
DDE (o,p')	ND	0.01
DDE (p,p')	ND	0.01
DDT (o,p')	ND	0.01
DDT (p,p')	ND	0.01
Deltamethrin	ND	0.01
Demeton-s-methyl	ND	0.01
Diazinon	ND	0.01
Dichlobenil	ND	0.01
Dichlofenthion	ND	0.01
Dichlofluanid	ND	0.01
Dichlorvos	ND	0.01
Dichloran	ND	0.01
Dicofol	ND	0.01
Dicrotophos	ND	0.01
Dieldrin	ND	0.01
Diflufenican	ND	0.01
Difenoconazole	ND	0.01
Dimethoate	ND	0.01
Dimethomorph	ND	0.01
Dimethenamid	ND	0.01
Diphenamid	ND	0.01
Diphenylamine	**0.018**	0.01
Disulfoton	ND	0.01
Endosulfan (alpha)	ND	0.01
Endosulfan (beta)	ND	0.01
Endosulfan sulphate	ND	0.01
Endrin	ND	0.01
EPN	ND	0.01
Epoxiconazole	ND	0.01
EPTC	ND	0.01
Ethiofencarb	ND	0.01
Ethion	ND	0.01
Ethoprofos	ND	0.01
Ethoxyquin	ND	0.01
Etridiazole	ND	0.01
Etrimfos	ND	0.01
Famphur	ND	0.01
Fenamiphos	ND	0.01
Fenarimol	ND	0.01
Fenchlorphos	ND	0.01
Fenitrothion	ND	0.01
Fenpiclonil	ND	0.01
Fenpropimorph	ND	0.01
Fenpropathrin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

Results: Pesticides in Soil

Laboratory Reference: 58715-5
Sample Identification: 5A3/2; B4/2; C2/2; D3/2; E2/2; F6/2 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Fensulfothion	ND	0.01
Fenthion	ND	0.01
Fenvalerate	ND	0.01
Fenoxaprop-ethyl	ND	0.01
Fenoxycarb	ND	0.02
Fipronil	ND	0.01
Flamprop-methyl	ND	0.01
Fluazinam	ND	0.1
Fluazifop-p-butyl	ND	0.01
Fludioxonil	ND	0.01
Flusilazole	ND	0.01
Flutriafol	ND	0.01
Fluvalinate	ND	0.02
Folpet	ND	0.02
Furalaxyl	ND	0.01
Furathiocarb	ND	0.01
Haloxyfop-etotyl	ND	0.01
Haloxyfop-methyl	ND	0.01
Hexachlorobenzene	ND	0.01
Heptachlor	ND	0.01
Heptachlor-epoxide	ND	0.01
Heptenophos	ND	0.01
Hexaconazole	ND	0.01
Hexazinone	ND	0.01
Indoxacarb	ND	0.01
Iodofenphos	ND	0.01
Iprodione	ND	0.01
Isofenphos	ND	0.01
Kresoxim-methyl	ND	0.01
Lindane	ND	0.01
Linuron	ND	0.01
Malathion	ND	0.01
Metalaxyl	ND	0.01
Methacrifos	ND	0.01
Methiocarb	ND	0.01
Methidathion	ND	0.01
Metolachlor	ND	0.01
Metribuzin	ND	0.01
Mevinphos	ND	0.01
Monocrotophos	ND	0.01
Myclobutanil	ND	0.01
Napropamide	ND	0.01
Nitrofen	ND	0.01
Nitrothal-isopropyl	ND	0.01
Norflurazon	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

Results: Pesticides in Soil

Laboratory Reference: 58715-5
Sample Identification: 5A3/2; B4/2; C2/2; D3/2; E2/2; F6/2 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Omethoate	ND	0.1
Oxadiazon	ND	0.01
Oxyfluorfen	ND	0.01
Paclobutrazol	ND	0.01
Parathion-methyl	ND	0.01
Parathion	ND	0.01
Penconazole	ND	0.01
Pendimethalin	ND	0.01
Permethrin	ND	0.01
Phorate	ND	0.01
Phorate sulphone	ND	0.05
Phorate sulphoxide	ND	0.05
Phosalone	ND	0.01
Phosmet	ND	0.01
Phosphamidon	ND	0.01
Piperonyl butoxide	**0.012**	0.01
Pirimicarb	ND	0.01
Pirimiphos-methyl	ND	0.01
Prochloraz	ND	0.05
Procymidone	ND	0.01
Prometryn	ND	0.01
Propachlor	ND	0.01
Propargite	ND	0.01
Propazine	ND	0.01
Propetamphos	ND	0.01
Propham	ND	0.01
Propiconazole	ND	0.01
Propoxur	ND	0.01
Propyzamide	ND	0.01
Prothiofos	ND	0.01
Pyrazophos	ND	0.01
Pyrimethanil	ND	0.01
Pyriproxyfen	ND	0.01
Quintozene	ND	0.01
Quinalphos	ND	0.01
Quizalofop-ethyl	ND	0.01
Simazine	**0.040**	0.01
Tebuconazole	ND	0.01
Tebufenpyrad	ND	0.01
Terbacil	ND	0.01
Terbufos	ND	0.01
Terbumeton	ND	0.01
Terbutylazine	ND	0.01
Terbutryn	ND	0.01
Tetrachlorvinphos	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-5
Sample Identification: 5A3/2; B4/2; C2/2; D3/2; E2/2; F6/2 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Tetradifon	ND	0.01
Tolclofos-methyl	ND	0.01
Tolylfluanid	ND	0.01
Tralkoxydim	ND	0.01
Triadimefon	ND	0.01
Triadimenol	ND	0.01
Triallate	ND	0.01
Triazophos	ND	0.01
Trifloxystrobin	ND	0.01
Trifluralin	ND	0.01
Vinclozolin	ND	0.01
Ametryn	**0.028**	0.010
Simetryn	**0.047**	0.010

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

Results: Pesticides in Soil

Laboratory Reference: 58715-6
Sample Identification: 6A11/2; B5/2; C1/2; D6/2; E3/2; F3/2 - Comp

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Acetochlor	ND	0.01
Alachlor	ND	0.01
Aldrin	ND	0.01
Atrazine	ND	0.01
Azaconazole	ND	0.01
Azinphos-methyl	ND	0.1
Azoxystrobin	ND	0.01
Benalaxyl	ND	0.01
Bendiocarb	ND	0.01
Benodanil	ND	0.01
BHC (alpha)	ND	0.01
BHC (beta)	ND	0.01
BHC (delta)	ND	0.01
Bifenthrin	ND	0.01
Binapacryl	ND	0.01
Bitertanol	ND	0.01
Bromacil	ND	0.01
Bromophos-ethyl	ND	0.01
Bromophos	ND	0.01
Bromopropylate	ND	0.01
Bupirimate	ND	0.01
Buprofezin	ND	0.01
Captan	ND	0.01
Carbaryl	ND	0.01
Carbofuran	ND	0.01
Carboxin	ND	0.01
Chlordane (cis)	ND	0.01
Chlordane (trans)	ND	0.01
Chlorfenvinphos	ND	0.01
Chlorobenzilate	ND	0.01
Chlorothalonil	ND	0.01
Chlorpropham	ND	0.01
Chlorpyrifos	ND	0.01
Chlorthal-dimethyl	ND	0.01
Chlozolinate	ND	0.01
Chlorpyrifos-methyl	ND	0.01
Clomazone	ND	0.01
Coumafos	ND	0.01
Cyanazine	ND	0.01
Cyfluthrin	ND	0.02
Cyhalothrin	ND	0.01
Cypermethrin	ND	0.03
Cyproconazole	ND	0.01
Cyprodinil	ND	0.01
DDD (o,p')	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH
Data Analyst: SP
Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-6
Sample Identification: 6A11/2; B5/2; C1/2; D6/2; E3/2; F3/2 - Comp

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
DDD (p,p')	ND	0.01
DDE (o,p')	ND	0.01
DDE (p,p')	ND	0.01
DDT (o,p')	ND	0.01
DDT (p,p')	ND	0.01
Deltamethrin	ND	0.01
Demeton-s-methyl	ND	0.01
Diazinon	ND	0.01
Dichlobenil	ND	0.01
Dichlofenthion	ND	0.01
Dichlofluanid	ND	0.01
Dichlorvos	ND	0.01
Dichloran	ND	0.01
Dicofol	ND	0.01
Dicrotophos	ND	0.01
Dieldrin	ND	0.01
Diflufenican	ND	0.01
Difenoconazole	ND	0.01
Dimethoate	ND	0.01
Dimethomorph	ND	0.01
Dimethenamid	ND	0.01
Diphenamid	ND	0.01
Diphenylamine	**0.061**	0.01
Disulfoton	ND	0.01
Endosulfan (alpha)	ND	0.01
Endosulfan (beta)	ND	0.01
Endosulfan sulphate	ND	0.01
Endrin	ND	0.01
EPN	ND	0.01
Epoxiconazole	ND	0.01
EPTC	ND	0.01
Ethiofencarb	ND	0.01
Ethion	ND	0.01
Ethoprofos	ND	0.01
Ethoxyquin	ND	0.01
Etridiazole	ND	0.01
Etrimfos	ND	0.01
Famphur	ND	0.01
Fenamiphos	ND	0.01
Fenarimol	ND	0.01
Fenchlorphos	ND	0.01
Fenitrothion	ND	0.01
Fenpiclonil	ND	0.01
Fenpropimorph	ND	0.01
Fenpropathrin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-6
Sample Identification: 6A11/2; B5/2; C1/2; D6/2; E3/2; F3/2 - Comp

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Fensulfothion	ND	0.01
Fenthion	ND	0.01
Fenvalerate	ND	0.01
Fenoxaprop-ethyl	ND	0.01
Fenoxycarb	ND	0.02
Fipronil	ND	0.01
Flamprop-methyl	ND	0.01
Fluazinam	ND	0.1
Fluazifop-p-butyl	ND	0.01
Fludioxonil	ND	0.01
Flusilazole	ND	0.01
Flutriafol	ND	0.01
Fluvalinate	ND	0.02
Folpet	ND	0.02
Furalaxyl	ND	0.01
Furathiocarb	ND	0.01
Haloxyfop-etotyl	ND	0.01
Haloxyfop-methyl	ND	0.01
Hexachlorobenzene	ND	0.01
Heptachlor	ND	0.01
Heptachlor-epoxide	ND	0.01
Heptenophos	ND	0.01
Hexaconazole	ND	0.01
Hexazinone	ND	0.01
Indoxacarb	ND	0.01
Iodofenphos	ND	0.01
Iprodione	ND	0.01
Isofenphos	ND	0.01
Kresoxim-methyl	ND	0.01
Lindane	ND	0.01
Linuron	ND	0.01
Malathion	ND	0.01
Metalaxyl	ND	0.01
Methacrifos	ND	0.01
Methiocarb	ND	0.01
Methidathion	ND	0.01
Metolachlor	ND	0.01
Metribuzin	ND	0.01
Mevinphos	ND	0.01
Monocrotophos	ND	0.01
Myclobutanil	ND	0.01
Napropamide	ND	0.01
Nitrofen	ND	0.01
Nitrothal-isopropyl	ND	0.01
Norflurazon	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

Results: Pesticides in Soil

Laboratory Reference: 58715-6
Sample Identification: 6A11/2; B5/2; C1/2; D6/2; E3/2; F3/2 - Comp

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Omethoate	ND	0.1
Oxadiazon	ND	0.01
Oxyfluorfen	ND	0.01
Paclobutrazol	ND	0.01
Parathion-methyl	ND	0.01
Parathion	ND	0.01
Penconazole	ND	0.01
Pendimethalin	ND	0.01
Permethrin	ND	0.01
Phorate	ND	0.01
Phorate sulphone	ND	0.05
Phorate sulphoxide	ND	0.05
Phosalone	ND	0.01
Phosmet	ND	0.01
Phosphamidon	ND	0.01
Piperonyl butoxide	ND	0.01
Pirimicarb	ND	0.01
Pirimiphos-methyl	ND	0.01
Prochloraz	ND	0.05
Procymidone	ND	0.01
Prometryn	ND	0.01
Propachlor	ND	0.01
Propargite	ND	0.01
Propazine	ND	0.01
Propetamphos	ND	0.01
Propham	ND	0.01
Propiconazole	ND	0.01
Propoxur	ND	0.01
Propyzamide	ND	0.01
Prothiofos	ND	0.01
Pyrazophos	ND	0.01
Pyrimethanil	ND	0.01
Pyriproxyfen	ND	0.01
Quintozene	ND	0.01
Quinalphos	ND	0.01
Quizalofop-ethyl	ND	0.01
Simazine	ND	0.01
Tebuconazole	ND	0.01
Tebufenpyrad	ND	0.01
Terbacil	ND	0.01
Terbufos	ND	0.01
Terbumeton	ND	0.01
Terbutylazine	ND	0.01
Terbutryn	ND	0.01
Tetrachlorvinphos	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-6
Sample Identification: 6A11/2; B5/2; C1/2; D6/2; E3/2; F3/2 - Comp

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Tetradifon	ND	0.01
Tolclofos-methyl	ND	0.01
Tolylfluanid	ND	0.01
Tralkoxydim	ND	0.01
Triadimefon	ND	0.01
Triadimenol	ND	0.01
Triallate	ND	0.01
Triazophos	ND	0.01
Trifloxystrobin	ND	0.01
Trifluralin	ND	0.01
Vinclozolin	ND	0.01
Ametryn	**0.024**	0.010

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-7
Sample Identification: 7A1/2; B3/2; C6/2; D1/2; E4/2; F5/2 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Acetochlor	ND	0.01
Alachlor	ND	0.01
Aldrin	ND	0.01
Atrazine	ND	0.01
Azaconazole	ND	0.01
Azinphos-methyl	ND	0.1
Azoxystrobin	ND	0.01
Benalaxyl	ND	0.01
Bendiocarb	ND	0.01
Benodanil	ND	0.01
BHC (alpha)	ND	0.01
BHC (beta)	ND	0.01
BHC (delta)	ND	0.01
Bifenthrin	ND	0.01
Binapacryl	ND	0.01
Bitertanol	ND	0.01
Bromacil	ND	0.01
Bromophos-ethyl	ND	0.01
Bromophos	ND	0.01
Bromopropylate	ND	0.01
Bupirimate	ND	0.01
Buprofezin	ND	0.01
Captan	ND	0.01
Carbaryl	ND	0.01
Carbofuran	ND	0.01
Carboxin	ND	0.01
Chlordane (cis)	ND	0.01
Chlordane (trans)	ND	0.01
Chlorfenvinphos	ND	0.01
Chlorobenzilate	ND	0.01
Chlorothalonil	ND	0.01
Chlorpropham	ND	0.01
Chlorpyrifos	ND	0.01
Chlorthal-dimethyl	ND	0.01
Chlozolinate	ND	0.01
Chlorpyrifos-methyl	ND	0.01
Clomazone	ND	0.01
Coumafos	ND	0.01
Cyanazine	ND	0.01
Cyfluthrin	ND	0.02
Cyhalothrin	ND	0.01
Cypermethrin	ND	0.03
Cyproconazole	ND	0.01
Cyprodinil	ND	0.01
DDD (o,p')	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH
Data Analyst: SP
Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-7
Sample Identification: 7A1/2; B3/2; C6/2; D1/2; E4/2; F5/2 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
DDD (p,p')	ND	0.01
DDE (o,p')	ND	0.01
DDE (p,p')	ND	0.01
DDT (o,p')	ND	0.01
DDT (p,p')	ND	0.01
Deltamethrin	ND	0.01
Demeton-s-methyl	ND	0.01
Diazinon	ND	0.01
Dichlobenil	ND	0.01
Dichlofenthion	ND	0.01
Dichlofluanid	ND	0.01
Dichlorvos	ND	0.01
Dichloran	ND	0.01
Dicofol	ND	0.01
Dicrotophos	ND	0.01
Dieldrin	ND	0.01
Diflufenican	ND	0.01
Difenoconazole	ND	0.01
Dimethoate	ND	0.01
Dimethomorph	ND	0.01
Dimethenamid	ND	0.01
Diphenamid	ND	0.01
Diphenylamine	ND	0.01
Disulfoton	ND	0.01
Endosulfan (alpha)	ND	0.01
Endosulfan (beta)	ND	0.01
Endosulfan sulphate	ND	0.01
Endrin	ND	0.01
EPN	ND	0.01
Epoxiconazole	ND	0.01
EPTC	ND	0.01
Ethiofencarb	ND	0.01
Ethion	ND	0.01
Ethoprofos	ND	0.01
Ethoxyquin	ND	0.01
Etridiazole	ND	0.01
Etrimfos	ND	0.01
Famphur	ND	0.01
Fenamiphos	ND	0.01
Fenarimol	ND	0.01
Fenchlorphos	ND	0.01
Fenitrothion	ND	0.01
Fenpiclonil	ND	0.01
Fenpropimorph	ND	0.01
Fenpropathrin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

Results: Pesticides in Soil

Laboratory Reference: 58715-7
Sample Identification: 7A1/2; B3/2; C6/2; D1/2; E4/2; F5/2 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Fensulfothion	ND	0.01
Fenthion	ND	0.01
Fenvalerate	ND	0.01
Fenoxaprop-ethyl	ND	0.01
Fenoxycarb	ND	0.02
Fipronil	ND	0.01
Flamprop-methyl	ND	0.01
Fluazinam	ND	0.1
Fluazifop-p-butyl	ND	0.01
Fludioxonil	ND	0.01
Flusilazole	ND	0.01
Flutriafol	ND	0.01
Fluvalinate	ND	0.02
Folpet	ND	0.02
Furalaxyl	ND	0.01
Furathiocarb	ND	0.01
Haloxyfop-etotyl	ND	0.01
Haloxyfop-methyl	ND	0.01
Hexachlorobenzene	ND	0.01
Heptachlor	ND	0.01
Heptachlor-epoxide	ND	0.01
Heptenophos	ND	0.01
Hexaconazole	ND	0.01
Hexazinone	ND	0.01
Indoxacarb	ND	0.01
Iodofenphos	ND	0.01
Iprodione	ND	0.01
Isofenphos	ND	0.01
Kresoxim-methyl	ND	0.01
Lindane	ND	0.01
Linuron	ND	0.01
Malathion	ND	0.01
Metalaxyl	ND	0.01
Methacrifos	ND	0.01
Methiocarb	ND	0.01
Methidathion	ND	0.01
Metolachlor	ND	0.01
Metribuzin	ND	0.01
Mevinphos	ND	0.01
Monocrotophos	ND	0.01
Myclobutanil	ND	0.01
Napropamide	ND	0.01
Nitrofen	ND	0.01
Nitrothal-isopropyl	ND	0.01
Norflurazon	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

Results: Pesticides in Soil

Laboratory Reference: 58715-7
Sample Identification: 7A1/2; B3/2; C6/2; D1/2; E4/2; F5/2 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Omethoate	ND	0.1
Oxadiazon	ND	0.01
Oxyfluorfen	ND	0.01
Paclobutrazol	ND	0.01
Parathion-methyl	ND	0.01
Parathion	ND	0.01
Penconazole	ND	0.01
Pendimethalin	ND	0.01
Permethrin	ND	0.01
Phorate	ND	0.01
Phorate sulphone	ND	0.05
Phorate sulphoxide	ND	0.05
Phosalone	ND	0.01
Phosmet	ND	0.01
Phosphamidon	ND	0.01
Piperonyl butoxide	ND	0.01
Pirimicarb	ND	0.01
Pirimiphos-methyl	ND	0.01
Prochloraz	ND	0.05
Procymidone	ND	0.01
Prometryn	ND	0.01
Propachlor	ND	0.01
Propargite	ND	0.01
Propazine	ND	0.01
Propetamphos	ND	0.01
Propham	ND	0.01
Propiconazole	ND	0.01
Propoxur	ND	0.01
Propyzamide	ND	0.01
Prothiofos	ND	0.01
Pyrazophos	ND	0.01
Pyrimethanil	ND	0.01
Pyriproxyfen	ND	0.01
Quintozene	ND	0.01
Quinalphos	ND	0.01
Quizalofop-ethyl	ND	0.01
Simazine	ND	0.01
Tebuconazole	ND	0.01
Tebufenpyrad	ND	0.01
Terbacil	ND	0.01
Terbufos	ND	0.01
Terbumeton	ND	0.01
Terbutylazine	ND	0.01
Terbutryn	ND	0.01
Tetrachlorvinphos	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-7
Sample Identification: 7A1/2; B3/2; C6/2; D1/2; E4/2; F5/2 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Tetradifon	ND	0.01
Tolclofos-methyl	ND	0.01
Tolylfluanid	ND	0.01
Tralkoxydim	ND	0.01
Triadimefon	ND	0.01
Triadimenol	ND	0.01
Triallate	ND	0.01
Triazophos	ND	0.01
Trifloxystrobin	ND	0.01
Trifluralin	ND	0.01
Vinclozolin	ND	0.01
Ametryn	**0.014**	0.010

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

Results: Pesticides in Soil

Laboratory Reference: 58715-8
Sample Identification: 8A6/2; B2/2; C4/2; D2/2; E5/2; F8/2 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Acetochlor	ND	0.01
Alachlor	ND	0.01
Aldrin	ND	0.01
Atrazine	ND	0.01
Azaconazole	ND	0.01
Azinphos-methyl	ND	0.1
Azoxystrobin	ND	0.01
Benalaxyl	ND	0.01
Bendiocarb	ND	0.01
Benodanil	ND	0.01
BHC (alpha)	ND	0.01
BHC (beta)	ND	0.01
BHC (delta)	ND	0.01
Bifenthrin	ND	0.01
Binapacryl	ND	0.01
Bitertanol	ND	0.01
Bromacil	ND	0.01
Bromophos-ethyl	ND	0.01
Bromophos	ND	0.01
Bromopropylate	ND	0.01
Bupirimate	ND	0.01
Buprofezin	ND	0.01
Captan	ND	0.01
Carbaryl	ND	0.01
Carbofuran	ND	0.01
Carboxin	ND	0.01
Chlordane (cis)	ND	0.01
Chlordane (trans)	ND	0.01
Chlorfenvinphos	ND	0.01
Chlorobenzilate	ND	0.01
Chlorothalonil	ND	0.01
Chlorpropham	ND	0.01
Chlorpyrifos	ND	0.01
Chlorthal-dimethyl	ND	0.01
Chlozolinate	ND	0.01
Chlorpyrifos-methyl	ND	0.01
Clomazone	ND	0.01
Coumafos	ND	0.01
Cyanazine	ND	0.01
Cyfluthrin	ND	0.02
Cyhalothrin	ND	0.01
Cypermethrin	ND	0.03
Cyproconazole	ND	0.01
Cyprodinil	ND	0.01
DDD (o,p')	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

Results: Pesticides in Soil

Laboratory Reference: 58715-8
Sample Identification: 8A6/2; B2/2; C4/2; D2/2; E5/2; F8/2 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
DDD (p,p')	ND	0.01
DDE (o,p')	ND	0.01
DDE (p,p')	ND	0.01
DDT (o,p')	ND	0.01
DDT (p,p')	ND	0.01
Deltamethrin	ND	0.01
Demeton-s-methyl	ND	0.01
Diazinon	ND	0.01
Dichlobenil	ND	0.01
Dichlofenthion	ND	0.01
Dichlofluanid	ND	0.01
Dichlorvos	ND	0.01
Dichloran	ND	0.01
Dicofol	ND	0.01
Dicrotophos	ND	0.01
Dieldrin	ND	0.01
Diflufenican	ND	0.01
Difenoconazole	ND	0.01
Dimethoate	ND	0.01
Dimethomorph	ND	0.01
Dimethenamid	ND	0.01
Diphenamid	ND	0.01
Diphenylamine	ND	0.01
Disulfoton	ND	0.01
Endosulfan (alpha)	ND	0.01
Endosulfan (beta)	ND	0.01
Endosulfan sulphate	ND	0.01
Endrin	ND	0.01
EPN	ND	0.01
Epoxiconazole	ND	0.01
EPTC	ND	0.01
Ethiofencarb	ND	0.01
Ethion	ND	0.01
Ethoprofos	ND	0.01
Ethoxyquin	ND	0.01
Etridiazole	ND	0.01
Etrimfos	ND	0.01
Famphur	ND	0.01
Fenamiphos	ND	0.01
Fenarimol	ND	0.01
Fenchlorphos	ND	0.01
Fenitrothion	ND	0.01
Fenpiclonil	ND	0.01
Fenpropimorph	ND	0.01
Fenpropathrin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-8
Sample Identification: 8A6/2; B2/2; C4/2; D2/2; E5/2; F8/2 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Fensulfothion	ND	0.01
Fenthion	ND	0.01
Fenvalerate	ND	0.01
Fenoxaprop-ethyl	ND	0.01
Fenoxycarb	ND	0.02
Fipronil	ND	0.01
Flamprop-methyl	ND	0.01
Fluazinam	ND	0.1
Fluazifop-p-butyl	ND	0.01
Fludioxonil	ND	0.01
Flusilazole	ND	0.01
Flutriafol	ND	0.01
Fluvalinate	ND	0.02
Folpet	ND	0.02
Furalaxyl	ND	0.01
Furathiocarb	ND	0.01
Haloxyfop-etotyl	ND	0.01
Haloxyfop-methyl	ND	0.01
Hexachlorobenzene	ND	0.01
Heptachlor	ND	0.01
Heptachlor-epoxide	ND	0.01
Heptenophos	ND	0.01
Hexaconazole	ND	0.01
Hexazinone	ND	0.01
Indoxacarb	ND	0.01
Iodofenphos	ND	0.01
Iprodione	ND	0.01
Isofenphos	ND	0.01
Kresoxim-methyl	ND	0.01
Lindane	ND	0.01
Linuron	ND	0.01
Malathion	ND	0.01
Metalaxyl	ND	0.01
Methacrifos	ND	0.01
Methiocarb	ND	0.01
Methidathion	ND	0.01
Metolachlor	ND	0.01
Metribuzin	ND	0.01
Mevinphos	ND	0.01
Monocrotophos	ND	0.01
Myclobutanil	ND	0.01
Napropamide	ND	0.01
Nitrofen	ND	0.01
Nitrothal-isopropyl	ND	0.01
Norflurazon	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

Results: Pesticides in Soil

Laboratory Reference: 58715-8
Sample Identification: 8A6/2; B2/2; C4/2; D2/2; E5/2; F8/2 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Omethoate	ND	0.1
Oxadiazon	ND	0.01
Oxyfluorfen	ND	0.01
Paclobutrazol	ND	0.01
Parathion-methyl	ND	0.01
Parathion	ND	0.01
Penconazole	ND	0.01
Pendimethalin	ND	0.01
Permethrin	ND	0.01
Phorate	ND	0.01
Phorate sulphone	ND	0.05
Phorate sulphoxide	ND	0.05
Phosalone	ND	0.01
Phosmet	ND	0.01
Phosphamidon	ND	0.01
Piperonyl butoxide	ND	0.01
Pirimicarb	ND	0.01
Pirimiphos-methyl	ND	0.01
Prochloraz	ND	0.05
Procymidone	ND	0.01
Prometryn	ND	0.01
Propachlor	ND	0.01
Propargite	ND	0.01
Propazine	ND	0.01
Propetamphos	ND	0.01
Propham	ND	0.01
Propiconazole	ND	0.01
Propoxur	ND	0.01
Propyzamide	ND	0.01
Prothiofos	ND	0.01
Pyrazophos	ND	0.01
Pyrimethanil	ND	0.01
Pyriproxyfen	ND	0.01
Quintozene	ND	0.01
Quinalphos	ND	0.01
Quizalofop-ethyl	ND	0.01
Simazine	ND	0.01
Tebuconazole	ND	0.01
Tebufenpyrad	ND	0.01
Terbacil	ND	0.01
Terbufos	ND	0.01
Terbumeton	ND	0.01
Terbutylazine	ND	0.01
Terbutryn	ND	0.01
Tetrachlorvinphos	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-8
Sample Identification: 8A6/2; B2/2; C4/2; D2/2; E5/2; F8/2 - Compc

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Tetradifon	ND	0.01
Tolclofos-methyl	ND	0.01
Tolylfluanid	ND	0.01
Tralkoxydim	ND	0.01
Triadimefon	ND	0.01
Triadimenol	ND	0.01
Triallate	ND	0.01
Triazophos	ND	0.01
Trifloxystrobin	ND	0.01
Trifluralin	ND	0.01
Vinclozolin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-9
Sample Identification: 9SS1 - SS6 - Composite 9

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Acetochlor	ND	0.01
Alachlor	ND	0.01
Aldrin	ND	0.01
Atrazine	ND	0.01
Azaconazole	ND	0.01
Azinphos-methyl	ND	0.1
Azoxystrobin	ND	0.01
Benalaxyl	ND	0.01
Bendiocarb	ND	0.01
Benodanil	ND	0.01
BHC (alpha)	ND	0.01
BHC (beta)	ND	0.01
BHC (delta)	ND	0.01
Bifenthrin	ND	0.01
Binapacryl	ND	0.01
Bitertanol	ND	0.01
Bromacil	ND	0.01
Bromophos-ethyl	ND	0.01
Bromophos	ND	0.01
Bromopropylate	ND	0.01
Bupirimate	ND	0.01
Buprofezin	ND	0.01
Captan	ND	0.01
Carbaryl	ND	0.01
Carbofuran	ND	0.01
Carboxin	ND	0.01
Chlordane (cis)	ND	0.01
Chlordane (trans)	ND	0.01
Chlorfenvinphos	ND	0.01
Chlorobenzilate	ND	0.01
Chlorothalonil	ND	0.01
Chlorpropham	ND	0.01
Chlorpyrifos	ND	0.01
Chlorthal-dimethyl	ND	0.01
Chlozolinate	ND	0.01
Chlorpyrifos-methyl	ND	0.01
Clomazone	ND	0.01
Coumafos	ND	0.01
Cyanazine	ND	0.01
Cyfluthrin	ND	0.02
Cyhalothrin	ND	0.01
Cypermethrin	ND	0.03
Cyproconazole	ND	0.01
Cyprodinil	ND	0.01
DDD (o,p')	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-9
Sample Identification: 9SS1 - SS6 - Composite 9

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
DDD (p,p')	ND	0.01
DDE (o,p')	ND	0.01
DDE (p,p')	ND	0.01
DDT (o,p')	ND	0.01
DDT (p,p')	ND	0.01
Deltamethrin	ND	0.01
Demeton-s-methyl	ND	0.01
Diazinon	ND	0.01
Dichlobenil	ND	0.01
Dichlofenthion	ND	0.01
Dichlofluanid	ND	0.01
Dichlorvos	ND	0.01
Dichloran	ND	0.01
Dicofol	ND	0.01
Dicrotophos	ND	0.01
Dieldrin	ND	0.01
Diflufenican	ND	0.01
Difenoconazole	ND	0.01
Dimethoate	ND	0.01
Dimethomorph	ND	0.01
Dimethenamid	ND	0.01
Diphenamid	ND	0.01
Diphenylamine	ND	0.01
Disulfoton	ND	0.01
Endosulfan (alpha)	ND	0.01
Endosulfan (beta)	ND	0.01
Endosulfan sulphate	ND	0.01
Endrin	ND	0.01
EPN	ND	0.01
Epoxiconazole	ND	0.01
EPTC	ND	0.01
Ethiofencarb	ND	0.01
Ethion	ND	0.01
Ethoprofos	ND	0.01
Ethoxyquin	ND	0.01
Etridiazole	ND	0.01
Etrimfos	ND	0.01
Famphur	ND	0.01
Fenamiphos	ND	0.01
Fenarimol	ND	0.01
Fenchlorphos	ND	0.01
Fenitrothion	ND	0.01
Fenpiclonil	ND	0.01
Fenpropimorph	ND	0.01
Fenpropathrin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-9
Sample Identification: 9SS1 - SS6 - Composite 9

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Fensulfothion	ND	0.01
Fenthion	ND	0.01
Fenvalerate	ND	0.01
Fenoxaprop-ethyl	ND	0.01
Fenoxycarb	ND	0.02
Fipronil	ND	0.01
Flamprop-methyl	ND	0.01
Fluazinam	ND	0.1
Fluazifop-p-butyl	ND	0.01
Fludioxonil	ND	0.01
Flusilazole	ND	0.01
Flutriafol	ND	0.01
Fluvalinate	ND	0.02
Folpet	ND	0.02
Furalaxyl	ND	0.01
Furathiocarb	ND	0.01
Haloxyfop-etotyl	ND	0.01
Haloxyfop-methyl	ND	0.01
Hexachlorobenzene	ND	0.01
Heptachlor	ND	0.01
Heptachlor-epoxide	ND	0.01
Heptenophos	ND	0.01
Hexaconazole	ND	0.01
Hexazinone	ND	0.01
Indoxacarb	ND	0.01
Iodofenphos	ND	0.01
Iprodione	ND	0.01
Isofenphos	ND	0.01
Kresoxim-methyl	ND	0.01
Lindane	ND	0.01
Linuron	ND	0.01
Malathion	ND	0.01
Metalaxyl	ND	0.01
Methacrifos	ND	0.01
Methiocarb	ND	0.01
Methidathion	ND	0.01
Metolachlor	ND	0.01
Metribuzin	ND	0.01
Mevinphos	ND	0.01
Monocrotophos	ND	0.01
Myclobutanil	ND	0.01
Napropamide	ND	0.01
Nitrofen	ND	0.01
Nitrothal-isopropyl	ND	0.01
Norflurazon	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-9
Sample Identification: 9SS1 - SS6 - Composite 9

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Omethoate	ND	0.1
Oxadiazon	ND	0.01
Oxyfluorfen	ND	0.01
Paclobutrazol	ND	0.01
Parathion-methyl	ND	0.01
Parathion	ND	0.01
Penconazole	ND	0.01
Pendimethalin	ND	0.01
Permethrin	ND	0.01
Phorate	ND	0.01
Phorate sulphone	ND	0.05
Phorate sulphoxide	ND	0.05
Phosalone	ND	0.01
Phosmet	ND	0.01
Phosphamidon	ND	0.01
Piperonyl butoxide	ND	0.01
Pirimicarb	ND	0.01
Pirimiphos-methyl	ND	0.01
Prochloraz	ND	0.05
Procymidone	ND	0.01
Prometryn	ND	0.01
Propachlor	ND	0.01
Propargite	ND	0.01
Propazine	ND	0.01
Propetamphos	ND	0.01
Propham	ND	0.01
Propiconazole	ND	0.01
Propoxur	ND	0.01
Propyzamide	ND	0.01
Prothiofos	ND	0.01
Pyrazophos	ND	0.01
Pyrimethanil	ND	0.01
Pyriproxyfen	ND	0.01
Quintozene	ND	0.01
Quinalphos	ND	0.01
Quizalofop-ethyl	ND	0.01
Simazine	ND	0.01
Tebuconazole	ND	0.01
Tebufenpyrad	ND	0.01
Terbacil	ND	0.01
Terbufos	ND	0.01
Terbumeton	ND	0.01
Terbutylazine	ND	0.01
Terbutryn	ND	0.01
Tetrachlorvinphos	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-9
Sample Identification: 9SS1 - SS6 - Composite 9

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Tetradifon	ND	0.01
Tolclofos-methyl	ND	0.01
Tolylfluanid	ND	0.01
Tralkoxydim	ND	0.01
Triadimefon	ND	0.01
Triadimenol	ND	0.01
Triallate	ND	0.01
Triazophos	ND	0.01
Trifloxystrobin	ND	0.01
Trifluralin	ND	0.01
Vinclozolin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-10
Sample Identification: 10SS7 -SS12 - Composite 10

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Acetochlor	ND	0.01
Alachlor	ND	0.01
Aldrin	ND	0.01
Atrazine	ND	0.01
Azaconazole	ND	0.01
Azinphos-methyl	ND	0.1
Azoxystrobin	ND	0.01
Benalaxyl	ND	0.01
Bendiocarb	ND	0.01
Benodanil	ND	0.01
BHC (alpha)	ND	0.01
BHC (beta)	ND	0.01
BHC (delta)	ND	0.01
Bifenthrin	ND	0.01
Binapacryl	ND	0.01
Bitertanol	ND	0.01
Bromacil	ND	0.01
Bromophos-ethyl	ND	0.01
Bromophos	ND	0.01
Bromopropylate	ND	0.01
Bupirimate	ND	0.01
Buprofezin	ND	0.01
Captan	ND	0.01
Carbaryl	ND	0.01
Carbofuran	ND	0.01
Carboxin	ND	0.01
Chlordane (cis)	ND	0.01
Chlordane (trans)	ND	0.01
Chlorfenvinphos	ND	0.01
Chlorobenzilate	ND	0.01
Chlorothalonil	ND	0.01
Chlorpropham	ND	0.01
Chlorpyrifos	ND	0.01
Chlorthal-dimethyl	ND	0.01
Chlozolinate	ND	0.01
Chlorpyrifos-methyl	ND	0.01
Clomazone	ND	0.01
Coumafos	ND	0.01
Cyanazine	ND	0.01
Cyfluthrin	ND	0.02
Cyhalothrin	ND	0.01
Cypermethrin	ND	0.03
Cyproconazole	ND	0.01
Cyprodinil	ND	0.01
DDD (o,p')	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-10
Sample Identification: 10SS7 -SS12 - Composite 10

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
DDD (p,p')	ND	0.01
DDE (o,p')	ND	0.01
DDE (p,p')	ND	0.01
DDT (o,p')	ND	0.01
DDT (p,p')	ND	0.01
Deltamethrin	ND	0.01
Demeton-s-methyl	ND	0.01
Diazinon	ND	0.01
Dichlobenil	ND	0.01
Dichlofenthion	**0.21**	0.01
Dichlofluanid	ND	0.01
Dichlorvos	ND	0.01
Dichloran	ND	0.01
Dicofol	ND	0.01
Dicrotophos	ND	0.01
Dieldrin	ND	0.01
Diflufenican	ND	0.01
Difenoconazole	ND	0.01
Dimethoate	ND	0.01
Dimethomorph	ND	0.01
Dimethenamid	ND	0.01
Diphenamid	ND	0.01
Diphenylamine	ND	0.01
Disulfoton	ND	0.01
Endosulfan (alpha)	ND	0.01
Endosulfan (beta)	ND	0.01
Endosulfan sulphate	ND	0.01
Endrin	ND	0.01
EPN	ND	0.01
Epoxiconazole	ND	0.01
EPTC	ND	0.01
Ethiofencarb	ND	0.01
Ethion	ND	0.01
Ethoprofos	ND	0.01
Ethoxyquin	ND	0.01
Etridiazole	ND	0.01
Etrimfos	ND	0.01
Famphur	ND	0.01
Fenamiphos	ND	0.01
Fenarimol	ND	0.01
Fenchlorphos	ND	0.01
Fenitrothion	ND	0.01
Fenpiclonil	ND	0.01
Fenpropimorph	ND	0.01
Fenpropathrin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-10
Sample Identification: 10SS7 -SS12 - Composite 10

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Fensulfothion	ND	0.01
Fenthion	ND	0.01
Fenvalerate	ND	0.01
Fenoxaprop-ethyl	ND	0.01
Fenoxycarb	ND	0.02
Fipronil	ND	0.01
Flamprop-methyl	ND	0.01
Fluazinam	ND	0.1
Fluazifop-p-butyl	ND	0.01
Fludioxonil	ND	0.01
Flusilazole	ND	0.01
Flutriafol	ND	0.01
Fluvalinate	ND	0.02
Folpet	ND	0.02
Furalaxyl	ND	0.01
Furathiocarb	ND	0.01
Haloxyfop-etotyl	ND	0.01
Haloxyfop-methyl	ND	0.01
Hexachlorobenzene	ND	0.01
Heptachlor	ND	0.01
Heptachlor-epoxide	ND	0.01
Heptenophos	ND	0.01
Hexaconazole	ND	0.01
Hexazinone	ND	0.01
Indoxacarb	ND	0.01
Iodofenphos	ND	0.01
Iprodione	ND	0.01
Isofenphos	ND	0.01
Kresoxim-methyl	ND	0.01
Lindane	ND	0.01
Linuron	ND	0.01
Malathion	ND	0.01
Metalaxyl	ND	0.01
Methacrifos	ND	0.01
Methiocarb	ND	0.01
Methidathion	ND	0.01
Metolachlor	ND	0.01
Metribuzin	ND	0.01
Mevinphos	ND	0.01
Monocrotophos	ND	0.01
Myclobutanil	ND	0.01
Napropamide	ND	0.01
Nitrofen	ND	0.01
Nitrothal-isopropyl	ND	0.01
Norflurazon	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

Results: Pesticides in Soil

Laboratory Reference: 58715-10
Sample Identification: 10SS7 -SS12 - Composite 10

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Omethoate	ND	0.1
Oxadiazon	ND	0.01
Oxyfluorfen	ND	0.01
Paclobutrazol	ND	0.01
Parathion-methyl	ND	0.01
Parathion	ND	0.01
Penconazole	ND	0.01
Pendimethalin	ND	0.01
Permethrin	ND	0.01
Phorate	ND	0.01
Phorate sulphone	ND	0.05
Phorate sulphoxide	ND	0.05
Phosalone	ND	0.01
Phosmet	ND	0.01
Phosphamidon	ND	0.01
Piperonyl butoxide	ND	0.01
Pirimicarb	ND	0.01
Pirimiphos-methyl	ND	0.01
Prochloraz	ND	0.05
Procymidone	ND	0.01
Prometryn	ND	0.01
Propachlor	ND	0.01
Propargite	ND	0.01
Propazine	ND	0.01
Propetamphos	ND	0.01
Propham	ND	0.01
Propiconazole	ND	0.01
Propoxur	ND	0.01
Propyzamide	ND	0.01
Prothiofos	ND	0.01
Pyrazophos	ND	0.01
Pyrimethanil	ND	0.01
Pyriproxyfen	ND	0.01
Quintozene	ND	0.01
Quinalphos	ND	0.01
Quizalofop-ethyl	ND	0.01
Simazine	**0.055**	0.01
Tebuconazole	ND	0.01
Tebufenpyrad	ND	0.01
Terbacil	ND	0.01
Terbufos	ND	0.01
Terbumeton	ND	0.01
Terbutylazine	ND	0.01
Terbutryn	ND	0.01
Tetrachlorvinphos	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-10
Sample Identification: 10SS7 -SS12 - Composite 10

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Tetradifon	ND	0.01
Tolclofos-methyl	ND	0.01
Tolylfluanid	ND	0.01
Tralkoxydim	ND	0.01
Triadimefon	ND	0.01
Triadimenol	ND	0.01
Triallate	ND	0.01
Triazophos	ND	0.01
Trifloxystrobin	ND	0.01
Trifluralin	ND	0.01
Vinclozolin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-11
Sample Identification: 11SS13/1-SS18/1 - Composite 11

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Acetochlor	ND	0.01
Alachlor	ND	0.01
Aldrin	ND	0.01
Atrazine	ND	0.01
Azaconazole	ND	0.01
Azinphos-methyl	ND	0.1
Azoxystrobin	ND	0.01
Benalaxyl	ND	0.01
Bendiocarb	ND	0.01
Benodanil	ND	0.01
BHC (alpha)	ND	0.01
BHC (beta)	ND	0.01
BHC (delta)	ND	0.01
Bifenthrin	ND	0.01
Binapacryl	ND	0.01
Bitertanol	ND	0.01
Bromacil	ND	0.01
Bromophos-ethyl	ND	0.01
Bromophos	ND	0.01
Bromopropylate	ND	0.01
Bupirimate	ND	0.01
Buprofezin	ND	0.01
Captan	ND	0.01
Carbaryl	ND	0.01
Carbofuran	ND	0.01
Carboxin	ND	0.01
Chlordane (cis)	ND	0.01
Chlordane (trans)	ND	0.01
Chlorfenvinphos	ND	0.01
Chlorobenzilate	ND	0.01
Chlorothalonil	ND	0.01
Chlorpropham	ND	0.01
Chlorpyrifos	ND	0.01
Chlorthal-dimethyl	ND	0.01
Chlozolinate	ND	0.01
Chlorpyrifos-methyl	ND	0.01
Clomazone	ND	0.01
Coumafos	ND	0.01
Cyanazine	ND	0.01
Cyfluthrin	ND	0.02
Cyhalothrin	ND	0.01
Cypermethrin	ND	0.03
Cyproconazole	ND	0.01
Cyprodinil	ND	0.01
DDD (o,p')	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-11
Sample Identification: 11SS13/1-SS18/1 - Composite 11

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
DDD (p,p')	ND	0.01
DDE (o,p')	ND	0.01
DDE (p,p')	ND	0.01
DDT (o,p')	ND	0.01
DDT (p,p')	ND	0.01
Deltamethrin	ND	0.01
Demeton-s-methyl	ND	0.01
Diazinon	ND	0.01
Dichlobenil	ND	0.01
Dichlofenthion	ND	0.01
Dichlofluanid	ND	0.01
Dichlorvos	ND	0.01
Dichloran	ND	0.01
Dicofol	ND	0.01
Dicrotophos	ND	0.01
Dieldrin	ND	0.01
Diflufenican	ND	0.01
Difenoconazole	ND	0.01
Dimethoate	ND	0.01
Dimethomorph	ND	0.01
Dimethenamid	ND	0.01
Diphenamid	ND	0.01
Diphenylamine	ND	0.01
Disulfoton	ND	0.01
Endosulfan (alpha)	ND	0.01
Endosulfan (beta)	ND	0.01
Endosulfan sulphate	ND	0.01
Endrin	ND	0.01
EPN	ND	0.01
Epoxiconazole	ND	0.01
EPTC	ND	0.01
Ethiofencarb	ND	0.01
Ethion	ND	0.01
Ethoprofos	ND	0.01
Ethoxyquin	ND	0.01
Etridiazole	ND	0.01
Etrimfos	ND	0.01
Famphur	ND	0.01
Fenamiphos	ND	0.01
Fenarimol	ND	0.01
Fenchlorphos	ND	0.01
Fenitrothion	ND	0.01
Fenpiclonil	ND	0.01
Fenpropimorph	ND	0.01
Fenpropathrin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-11
Sample Identification: 11SS13/1-SS18/1 - Composite 11

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Fensulfothion	ND	0.01
Fenthion	ND	0.01
Fenvalerate	ND	0.01
Fenoxaprop-ethyl	ND	0.01
Fenoxycarb	ND	0.02
Fipronil	ND	0.01
Flamprop-methyl	ND	0.01
Fluazinam	ND	0.1
Fluazifop-p-butyl	ND	0.01
Fludioxonil	ND	0.01
Flusilazole	ND	0.01
Flutriafol	ND	0.01
Fluvalinate	ND	0.02
Folpet	ND	0.02
Furalaxyl	ND	0.01
Furathiocarb	ND	0.01
Haloxyfop-etotyl	ND	0.01
Haloxyfop-methyl	ND	0.01
Hexachlorobenzene	ND	0.01
Heptachlor	ND	0.01
Heptachlor-epoxide	ND	0.01
Heptenophos	ND	0.01
Hexaconazole	ND	0.01
Hexazinone	ND	0.01
Indoxacarb	ND	0.01
Iodofenphos	ND	0.01
Iprodione	ND	0.01
Isofenphos	ND	0.01
Kresoxim-methyl	ND	0.01
Lindane	ND	0.01
Linuron	ND	0.01
Malathion	ND	0.01
Metalaxyl	ND	0.01
Methacrifos	ND	0.01
Methiocarb	ND	0.01
Methidathion	ND	0.01
Metolachlor	ND	0.01
Metribuzin	ND	0.01
Mevinphos	ND	0.01
Monocrotophos	ND	0.01
Myclobutanil	ND	0.01
Napropamide	ND	0.01
Nitrofen	ND	0.01
Nitrothal-isopropyl	ND	0.01
Norflurazon	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-11
Sample Identification: 11SS13/1-SS18/1 - Composite 11

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Omethoate	ND	0.1
Oxadiazon	ND	0.01
Oxyfluorfen	ND	0.01
Paclobutrazol	ND	0.01
Parathion-methyl	ND	0.01
Parathion	ND	0.01
Penconazole	ND	0.01
Pendimethalin	ND	0.01
Permethrin	ND	0.01
Phorate	ND	0.01
Phorate sulphone	ND	0.05
Phorate sulphoxide	ND	0.05
Phosalone	ND	0.01
Phosmet	ND	0.01
Phosphamidon	ND	0.01
Piperonyl butoxide	ND	0.01
Pirimicarb	ND	0.01
Pirimiphos-methyl	ND	0.01
Prochloraz	ND	0.05
Procymidone	ND	0.01
Prometryn	ND	0.01
Propachlor	ND	0.01
Propargite	ND	0.01
Propazine	ND	0.01
Propetamphos	ND	0.01
Propham	ND	0.01
Propiconazole	ND	0.01
Propoxur	ND	0.01
Propyzamide	ND	0.01
Prothiofos	ND	0.01
Pyrazophos	ND	0.01
Pyrimethanil	ND	0.01
Pyriproxyfen	ND	0.01
Quintozene	ND	0.01
Quinalphos	ND	0.01
Quizalofop-ethyl	ND	0.01
Simazine	ND	0.01
Tebuconazole	ND	0.01
Tebufenpyrad	ND	0.01
Terbacil	ND	0.01
Terbufos	ND	0.01
Terbumeton	ND	0.01
Terbutylazine	ND	0.01
Terbutryn	ND	0.01
Tetrachlorvinphos	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-11
Sample Identification: 11SS13/1-SS18/1 - Composite 11

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Tetradifon	ND	0.01
Tolclofos-methyl	ND	0.01
Tolylfluanid	ND	0.01
Tralkoxydim	ND	0.01
Triadimefon	ND	0.01
Triadimenol	ND	0.01
Triallate	ND	0.01
Triazophos	ND	0.01
Trifloxystrobin	ND	0.01
Trifluralin	ND	0.01
Vinclozolin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-12
Sample Identification: 12SS19 - SS24 - Composite 12

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Acetochlor	ND	0.01
Alachlor	ND	0.01
Aldrin	ND	0.01
Atrazine	ND	0.01
Azaconazole	ND	0.01
Azinphos-methyl	ND	0.1
Azoxystrobin	ND	0.01
Benalaxyl	ND	0.01
Bendiocarb	ND	0.01
Benodanil	ND	0.01
BHC (alpha)	ND	0.01
BHC (beta)	ND	0.01
BHC (delta)	ND	0.01
Bifenthrin	ND	0.01
Binapacryl	ND	0.01
Bitertanol	ND	0.01
Bromacil	ND	0.01
Bromophos-ethyl	ND	0.01
Bromophos	ND	0.01
Bromopropylate	ND	0.01
Bupirimate	ND	0.01
Buprofezin	ND	0.01
Captan	ND	0.01
Carbaryl	ND	0.01
Carbofuran	ND	0.01
Carboxin	ND	0.01
Chlordane (cis)	ND	0.01
Chlordane (trans)	ND	0.01
Chlorfenvinphos	ND	0.01
Chlorobenzilate	ND	0.01
Chlorothalonil	ND	0.01
Chlorpropham	ND	0.01
Chlorpyrifos	ND	0.01
Chlorthal-dimethyl	ND	0.01
Chlozolinate	ND	0.01
Chlorpyrifos-methyl	ND	0.01
Clomazone	ND	0.01
Coumafos	ND	0.01
Cyanazine	ND	0.01
Cyfluthrin	ND	0.02
Cyhalothrin	ND	0.01
Cypermethrin	ND	0.03
Cyproconazole	ND	0.01
Cyprodinil	ND	0.01
DDD (o,p')	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

Results: Pesticides in Soil

Laboratory Reference: 58715-12
Sample Identification: 12SS19 - SS24 - Composite 12

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
DDD (p,p')	ND	0.01
DDE (o,p')	ND	0.01
DDE (p,p')	ND	0.01
DDT (o,p')	ND	0.01
DDT (p,p')	ND	0.01
Deltamethrin	ND	0.01
Demeton-s-methyl	ND	0.01
Diazinon	ND	0.01
Dichlobenil	ND	0.01
Dichlofenthion	ND	0.01
Dichlofluanid	ND	0.01
Dichlorvos	ND	0.01
Dichloran	ND	0.01
Dicofol	ND	0.01
Dicrotophos	ND	0.01
Dieldrin	ND	0.01
Diflufenican	ND	0.01
Difenoconazole	ND	0.01
Dimethoate	ND	0.01
Dimethomorph	ND	0.01
Dimethenamid	ND	0.01
Diphenamid	ND	0.01
Diphenylamine	ND	0.01
Disulfoton	ND	0.01
Endosulfan (alpha)	ND	0.01
Endosulfan (beta)	ND	0.01
Endosulfan sulphate	ND	0.01
Endrin	ND	0.01
EPN	ND	0.01
Epoxiconazole	ND	0.01
EPTC	ND	0.01
Ethiofencarb	ND	0.01
Ethion	ND	0.01
Ethoprofos	ND	0.01
Ethoxyquin	ND	0.01
Etridiazole	ND	0.01
Etrimfos	ND	0.01
Famphur	ND	0.01
Fenamiphos	ND	0.01
Fenarimol	ND	0.01
Fenchlorphos	ND	0.01
Fenitrothion	ND	0.01
Fenpiclonil	ND	0.01
Fenpropimorph	ND	0.01
Fenpropathrin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-12
Sample Identification: 12SS19 - SS24 - Composite 12

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Fensulfothion	ND	0.01
Fenthion	ND	0.01
Fenvalerate	ND	0.01
Fenoxaprop-ethyl	ND	0.01
Fenoxycarb	ND	0.02
Fipronil	ND	0.01
Flamprop-methyl	ND	0.01
Fluazinam	ND	0.1
Fluazifop-p-butyl	ND	0.01
Fludioxonil	ND	0.01
Flusilazole	ND	0.01
Flutriafol	ND	0.01
Fluvalinate	ND	0.02
Folpet	ND	0.02
Furalaxyl	ND	0.01
Furathiocarb	ND	0.01
Haloxyfop-etotyl	ND	0.01
Haloxyfop-methyl	ND	0.01
Hexachlorobenzene	ND	0.01
Heptachlor	ND	0.01
Heptachlor-epoxide	ND	0.01
Heptenophos	ND	0.01
Hexaconazole	ND	0.01
Hexazinone	ND	0.01
Indoxacarb	ND	0.01
Iodofenphos	ND	0.01
Iprodione	ND	0.01
Isofenphos	ND	0.01
Kresoxim-methyl	ND	0.01
Lindane	ND	0.01
Linuron	ND	0.01
Malathion	ND	0.01
Metalaxyl	ND	0.01
Methacrifos	ND	0.01
Methiocarb	ND	0.01
Methidathion	ND	0.01
Metolachlor	ND	0.01
Metribuzin	ND	0.01
Mevinphos	ND	0.01
Monocrotophos	ND	0.01
Myclobutanil	ND	0.01
Napropamide	ND	0.01
Nitrofen	ND	0.01
Nitrothal-isopropyl	ND	0.01
Norflurazon	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-12
Sample Identification: 12SS19 - SS24 - Composite 12

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Omethoate	ND	0.1
Oxadiazon	ND	0.01
Oxyfluorfen	ND	0.01
Paclobutrazol	ND	0.01
Parathion-methyl	ND	0.01
Parathion	ND	0.01
Penconazole	ND	0.01
Pendimethalin	ND	0.01
Permethrin	ND	0.01
Phorate	ND	0.01
Phorate sulphone	ND	0.05
Phorate sulphoxide	ND	0.05
Phosalone	ND	0.01
Phosmet	ND	0.01
Phosphamidon	ND	0.01
Piperonyl butoxide	ND	0.01
Pirimicarb	ND	0.01
Pirimiphos-methyl	ND	0.01
Prochloraz	ND	0.05
Procymidone	ND	0.01
Prometryn	ND	0.01
Propachlor	ND	0.01
Propargite	ND	0.01
Propazine	ND	0.01
Propetamphos	ND	0.01
Propham	ND	0.01
Propiconazole	ND	0.01
Propoxur	ND	0.01
Propyzamide	ND	0.01
Prothiofos	ND	0.01
Pyrazophos	ND	0.01
Pyrimethanil	ND	0.01
Pyriproxyfen	ND	0.01
Quintozene	ND	0.01
Quinalphos	ND	0.01
Quizalofop-ethyl	ND	0.01
Simazine	ND	0.01
Tebuconazole	ND	0.01
Tebufenpyrad	ND	0.01
Terbacil	ND	0.01
Terbufos	ND	0.01
Terbumeton	ND	0.01
Terbutylazine	ND	0.01
Terbutryn	ND	0.01
Tetrachlorvinphos	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-12
Sample Identification: 12SS19 - SS24 - Composite 12

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Tetradifon	ND	0.01
Tolclofos-methyl	ND	0.01
Tolylfluanid	ND	0.01
Tralkoxydim	ND	0.01
Triadimefon	ND	0.01
Triadimenol	ND	0.01
Triallate	ND	0.01
Triazophos	ND	0.01
Trifloxystrobin	ND	0.01
Trifluralin	ND	0.01
Vinclozolin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-13
Sample Identification: 13SS25 - SS31 - Composite 13

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Acetochlor	ND	0.01
Alachlor	ND	0.01
Aldrin	ND	0.01
Atrazine	ND	0.01
Azaconazole	ND	0.01
Azinphos-methyl	ND	0.1
Azoxystrobin	ND	0.01
Benalaxyl	ND	0.01
Bendiocarb	ND	0.01
Benodanil	ND	0.01
BHC (alpha)	ND	0.01
BHC (beta)	ND	0.01
BHC (delta)	ND	0.01
Bifenthrin	ND	0.01
Binapacryl	ND	0.01
Bitertanol	ND	0.01
Bromacil	ND	0.01
Bromophos-ethyl	ND	0.01
Bromophos	ND	0.01
Bromopropylate	ND	0.01
Bupirimate	ND	0.01
Buprofezin	ND	0.01
Captan	ND	0.01
Carbaryl	ND	0.01
Carbofuran	ND	0.01
Carboxin	ND	0.01
Chlordane (cis)	ND	0.01
Chlordane (trans)	ND	0.01
Chlorfenvinphos	ND	0.01
Chlorobenzilate	ND	0.01
Chlorothalonil	ND	0.01
Chlorpropham	ND	0.01
Chlorpyrifos	ND	0.01
Chlorthal-dimethyl	ND	0.01
Chlozolinate	ND	0.01
Chlorpyrifos-methyl	ND	0.01
Clomazone	ND	0.01
Coumafos	ND	0.01
Cyanazine	ND	0.01
Cyfluthrin	ND	0.02
Cyhalothrin	ND	0.01
Cypermethrin	ND	0.03
Cyproconazole	ND	0.01
Cyprodinil	ND	0.01
DDD (o,p')	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-13
Sample Identification: 13SS25 - SS31 - Composite 13

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
DDD (p,p')	ND	0.01
DDE (o,p')	ND	0.01
DDE (p,p')	ND	0.01
DDT (o,p')	ND	0.01
DDT (p,p')	ND	0.01
Deltamethrin	ND	0.01
Demeton-s-methyl	ND	0.01
Diazinon	ND	0.01
Dichlobenil	ND	0.01
Dichlofenthion	ND	0.01
Dichlofluanid	ND	0.01
Dichlorvos	ND	0.01
Dichloran	ND	0.01
Dicofol	ND	0.01
Dicrotophos	ND	0.01
Dieldrin	ND	0.01
Diflufenican	ND	0.01
Difenoconazole	ND	0.01
Dimethoate	ND	0.01
Dimethomorph	ND	0.01
Dimethenamid	ND	0.01
Diphenamid	ND	0.01
Diphenylamine	ND	0.01
Disulfoton	ND	0.01
Endosulfan (alpha)	ND	0.01
Endosulfan (beta)	ND	0.01
Endosulfan sulphate	ND	0.01
Endrin	ND	0.01
EPN	ND	0.01
Epoxiconazole	ND	0.01
EPTC	ND	0.01
Ethiofencarb	ND	0.01
Ethion	ND	0.01
Ethoprofos	ND	0.01
Ethoxyquin	ND	0.01
Etridiazole	ND	0.01
Etrimfos	ND	0.01
Famphur	ND	0.01
Fenamiphos	ND	0.01
Fenarimol	ND	0.01
Fenchlorphos	ND	0.01
Fenitrothion	ND	0.01
Fenpiclonil	ND	0.01
Fenpropimorph	ND	0.01
Fenpropathrin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

Results: Pesticides in Soil

Laboratory Reference: 58715-13
Sample Identification: 13SS25 - SS31 - Composite 13

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Fensulfothion	ND	0.01
Fenthion	ND	0.01
Fenvalerate	ND	0.01
Fenoxaprop-ethyl	ND	0.01
Fenoxycarb	ND	0.02
Fipronil	ND	0.01
Flamprop-methyl	ND	0.01
Fluazinam	ND	0.1
Fluazifop-p-butyl	ND	0.01
Fludioxonil	ND	0.01
Flusilazole	ND	0.01
Flutriafol	ND	0.01
Fluvalinate	ND	0.02
Folpet	ND	0.02
Furalaxyl	ND	0.01
Furathiocarb	ND	0.01
Haloxyfop-etotyl	ND	0.01
Haloxyfop-methyl	ND	0.01
Hexachlorobenzene	ND	0.01
Heptachlor	ND	0.01
Heptachlor-epoxide	ND	0.01
Heptenophos	ND	0.01
Hexaconazole	ND	0.01
Hexazinone	ND	0.01
Indoxacarb	ND	0.01
Iodofenphos	ND	0.01
Iprodione	ND	0.01
Isofenphos	ND	0.01
Kresoxim-methyl	ND	0.01
Lindane	ND	0.01
Linuron	ND	0.01
Malathion	ND	0.01
Metalaxyl	ND	0.01
Methacrifos	ND	0.01
Methiocarb	ND	0.01
Methidathion	ND	0.01
Metolachlor	ND	0.01
Metribuzin	ND	0.01
Mevinphos	ND	0.01
Monocrotophos	ND	0.01
Myclobutanil	ND	0.01
Napropamide	ND	0.01
Nitrofen	ND	0.01
Nitrothal-isopropyl	ND	0.01
Norflurazon	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-13
Sample Identification: 13SS25 - SS31 - Composite 13

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Omethoate	ND	0.1
Oxadiazon	ND	0.01
Oxyfluorfen	ND	0.01
Paclobutrazol	ND	0.01
Parathion-methyl	ND	0.01
Parathion	ND	0.01
Penconazole	ND	0.01
Pendimethalin	ND	0.01
Permethrin	ND	0.01
Phorate	ND	0.01
Phorate sulphone	ND	0.05
Phorate sulphoxide	ND	0.05
Phosalone	ND	0.01
Phosmet	ND	0.01
Phosphamidon	ND	0.01
Piperonyl butoxide	ND	0.01
Pirimicarb	ND	0.01
Pirimiphos-methyl	ND	0.01
Prochloraz	ND	0.05
Procymidone	ND	0.01
Prometryn	ND	0.01
Propachlor	ND	0.01
Propargite	ND	0.01
Propazine	ND	0.01
Propetamphos	ND	0.01
Propham	ND	0.01
Propiconazole	ND	0.01
Propoxur	ND	0.01
Propyzamide	ND	0.01
Prothiofos	ND	0.01
Pyrazophos	ND	0.01
Pyrimethanil	ND	0.01
Pyriproxyfen	ND	0.01
Quintozene	ND	0.01
Quinalphos	ND	0.01
Quizalofop-ethyl	ND	0.01
Simazine	ND	0.01
Tebuconazole	ND	0.01
Tebufenpyrad	ND	0.01
Terbacil	ND	0.01
Terbufos	ND	0.01
Terbumeton	ND	0.01
Terbutylazine	ND	0.01
Terbutryn	ND	0.01
Tetrachlorvinphos	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected
* = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-13
Sample Identification: 13SS25 - SS31 - Composite 13

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Tetradifon	ND	0.01
Tolclofos-methyl	ND	0.01
Tolylfluanid	ND	0.01
Tralkoxydim	ND	0.01
Triadimefon	ND	0.01
Triadimenol	ND	0.01
Triallate	ND	0.01
Triazophos	ND	0.01
Trifloxystrobin	ND	0.01
Trifluralin	ND	0.01
Vinclozolin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-14
Sample Identification: 14 SS13/2 - SS 18/2, Composite 14

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Acetochlor	ND	0.01
Alachlor	ND	0.01
Aldrin	ND	0.01
Atrazine	ND	0.01
Azaconazole	ND	0.01
Azinphos-methyl	ND	0.1
Azoxystrobin	ND	0.01
Benalaxyl	ND	0.01
Bendiocarb	ND	0.01
Benodanil	ND	0.01
BHC (alpha)	ND	0.01
BHC (beta)	ND	0.01
BHC (delta)	ND	0.01
Bifenthrin	ND	0.01
Binapacryl	ND	0.01
Bitertanol	ND	0.01
Bromacil	ND	0.01
Bromophos-ethyl	ND	0.01
Bromophos	ND	0.01
Bromopropylate	ND	0.01
Bupirimate	ND	0.01
Buprofezin	ND	0.01
Captan	ND	0.01
Carbaryl	ND	0.01
Carbofuran	ND	0.01
Carboxin	ND	0.01
Chlordane (cis)	ND	0.01
Chlordane (trans)	ND	0.01
Chlorfenvinphos	ND	0.01
Chlorobenzilate	ND	0.01
Chlorothalonil	ND	0.01
Chlorpropham	ND	0.01
Chlorpyrifos	ND	0.01
Chlorthal-dimethyl	ND	0.01
Chlozolinate	ND	0.01
Chlorpyrifos-methyl	ND	0.01
Clomazone	ND	0.01
Coumafos	ND	0.01
Cyanazine	ND	0.01
Cyfluthrin	ND	0.02
Cyhalothrin	ND	0.01
Cypermethrin	ND	0.03
Cyproconazole	ND	0.01
Cyprodinil	ND	0.01
DDD (o,p')	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-14
Sample Identification: 14 SS13/2 - SS 18/2, Composite 14

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
DDD (p,p')	ND	0.01
DDE (o,p')	ND	0.01
DDE (p,p')	ND	0.01
DDT (o,p')	ND	0.01
DDT (p,p')	ND	0.01
Deltamethrin	ND	0.01
Demeton-s-methyl	ND	0.01
Diazinon	ND	0.01
Dichlobenil	ND	0.01
Dichlofenthion	ND	0.01
Dichlofluanid	ND	0.01
Dichlorvos	ND	0.01
Dichloran	ND	0.01
Dicofol	ND	0.01
Dicrotophos	ND	0.01
Dieldrin	**0.094**	0.01
Diflufenican	ND	0.01
Difenoconazole	ND	0.01
Dimethoate	ND	0.01
Dimethomorph	ND	0.01
Dimethenamid	ND	0.01
Diphenamid	ND	0.01
Diphenylamine	ND	0.01
Disulfoton	ND	0.01
Endosulfan (alpha)	ND	0.01
Endosulfan (beta)	ND	0.01
Endosulfan sulphate	ND	0.01
Endrin	ND	0.01
EPN	ND	0.01
Epoxiconazole	ND	0.01
EPTC	ND	0.01
Ethiofencarb	ND	0.01
Ethion	ND	0.01
Ethoprofos	ND	0.01
Ethoxyquin	ND	0.01
Etridiazole	ND	0.01
Etrimfos	ND	0.01
Famphur	ND	0.01
Fenamiphos	ND	0.01
Fenarimol	ND	0.01
Fenchlorphos	ND	0.01
Fenitrothion	ND	0.01
Fenpiclonil	ND	0.01
Fenpropimorph	ND	0.01
Fenpropathrin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-14
Sample Identification: 14 SS13/2 - SS 18/2, Composite 14

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Fensulfothion	ND	0.01
Fenthion	ND	0.01
Fenvalerate	ND	0.01
Fenoxaprop-ethyl	ND	0.01
Fenoxycarb	ND	0.02
Fipronil	ND	0.01
Flamprop-methyl	ND	0.01
Fluazinam	ND	0.1
Fluazifop-p-butyl	ND	0.01
Fludioxonil	ND	0.01
Flusilazole	ND	0.01
Flutriafol	ND	0.01
Fluvalinate	ND	0.02
Folpet	ND	0.02
Furalaxyl	ND	0.01
Furathiocarb	ND	0.01
Haloxyfop-etotyl	ND	0.01
Haloxyfop-methyl	ND	0.01
Hexachlorobenzene	ND	0.01
Heptachlor	ND	0.01
Heptachlor-epoxide	ND	0.01
Heptenophos	ND	0.01
Hexaconazole	ND	0.01
Hexazinone	ND	0.01
Indoxacarb	ND	0.01
Iodofenphos	ND	0.01
Iprodione	ND	0.01
Isofenphos	ND	0.01
Kresoxim-methyl	ND	0.01
Lindane	ND	0.01
Linuron	ND	0.01
Malathion	ND	0.01
Metalaxyl	ND	0.01
Methacrifos	ND	0.01
Methiocarb	ND	0.01
Methidathion	ND	0.01
Metolachlor	ND	0.01
Metribuzin	ND	0.01
Mevinphos	ND	0.01
Monocrotophos	ND	0.01
Myclobutanil	ND	0.01
Napropamide	ND	0.01
Nitrofen	ND	0.01
Nitrothal-isopropyl	ND	0.01
Norflurazon	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-14
Sample Identification: 14 SS13/2 - SS 18/2, Composite 14

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Omethoate	ND	0.1
Oxadiazon	ND	0.01
Oxyfluorfen	ND	0.01
Paclobutrazol	ND	0.01
Parathion-methyl	ND	0.01
Parathion	ND	0.01
Penconazole	ND	0.01
Pendimethalin	ND	0.01
Permethrin	ND	0.01
Phorate	ND	0.01
Phorate sulphone	ND	0.05
Phorate sulphoxide	ND	0.05
Phosalone	ND	0.01
Phosmet	ND	0.01
Phosphamidon	ND	0.01
Piperonyl butoxide	ND	0.01
Pirimicarb	ND	0.01
Pirimiphos-methyl	ND	0.01
Prochloraz	ND	0.05
Procymidone	ND	0.01
Prometryn	ND	0.01
Propachlor	ND	0.01
Propargite	ND	0.01
Propazine	ND	0.01
Propetamphos	ND	0.01
Propham	ND	0.01
Propiconazole	ND	0.01
Propoxur	ND	0.01
Propyzamide	ND	0.01
Prothiofos	ND	0.01
Pyrazophos	ND	0.01
Pyrimethanil	ND	0.01
Pyriproxyfen	ND	0.01
Quintozene	ND	0.01
Quinalphos	ND	0.01
Quizalofop-ethyl	ND	0.01
Simazine	ND	0.01
Tebuconazole	ND	0.01
Tebufenpyrad	ND	0.01
Terbacil	ND	0.01
Terbufos	ND	0.01
Terbumeton	ND	0.01
Terbutylazine	ND	0.01
Terbutryn	ND	0.01
Tetrachlorvinphos	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

17 August 2009

Results: Pesticides in Soil

Laboratory Reference: 58715-14
Sample Identification: 14 SS13/2 - SS 18/2, Composite 14

Date Received: 20 Jul 2009
Date Extracted: 28 Jul 2009
Date Analysed: 03 Aug 2009

Compounds	Result ¥ (mg/kg)	MDL *
Tetradifon	ND	0.01
Tolclofos-methyl	ND	0.01
Tolylfluanid	ND	0.01
Tralkoxydim	ND	0.01
Triadimefon	ND	0.01
Triadimenol	ND	0.01
Triallate	ND	0.01
Triazophos	ND	0.01
Trifloxystrobin	ND	0.01
Trifluralin	ND	0.01
Vinclozolin	ND	0.01

¥ = Results are reported on a dry weight basis.
ND = Not Detected * = Method Detection Limit

Lab Analyst: KH Data Analyst: SP Authorised: Koos Hoogenboom

AsureQuality

1C Quadrant Drive, Gracefield
PO Box 31 242, Lower Hutt
Wellington, New Zealand

T 64 4 5708500
F 64 4 5708176
W www.asurequality.com

Certificate of Analysis

Date Issued: 10-Aug-09

Client: Pattle Delamore Partners Ltd
Level 4, PDP House
235 Broadway
Newmarket
AUCKLAND

Attention: Rod Lidgard

Date Received: 20-Jul-09

AsureQuality Lab. Reference: 58715

Sample Type: Soil

Analysis: **Tetrachlorobenzenes**

Method:

The sample was extracted with organic solvent and the extract analysed by gas chromatography - mass spectrometry.

Results are reported to two significant figures in milligrams per kilogram (mg/kg), equivalent to ppm, on a dry weight basis. Detection limits are reported to one significant figure.

Unless requested, samples will be disposed of eight weeks from the date of this report.

Comments:

J. Fry
Scientist
AsureQuality Limited

Results: Tetrachlorobenzenes

Sample Identification: Composite 1

Laboratory Reference: 58715-1 Date Received: 20-Jul-09

Date Extracted: 31-Jul-09 Date Analysed: 31-Jul-09

Analyte	Conc.† (mg/kg)
1,2,3,5 + 1,2,4,5-tetrachlorobenzene	< 1
1,2,3,4-tetrachlorobenzene	< 1

† = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JF Authorised: Joanne Fry

Results: Tetrachlorobenzenes

Sample Identification: Composite 2

Laboratory Reference: 58715-2 Date Received: 20-Jul-09

Date Extracted: 31-Jul-09 Date Analysed: 31-Jul-09

Analyte	Conc.† (mg/kg)
1,2,3,5 + 1,2,4,5-tetrachlorobenzene	< 1
1,2,3,4-tetrachlorobenzene	< 1

† = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JF Authorised: Joanne Fry

Results: Tetrachlorobenzenes

Sample Identification: Composite 3

Laboratory Reference: 58715-3 Date Received: 20-Jul-09

Date Extracted: 31-Jul-09 Date Analysed: 31-Jul-09

Analyte	Conc.† (mg/kg)
1,2,3,5 + 1,2,4,5-tetrachlorobenzene	< 1
1,2,3,4-tetrachlorobenzene	< 1

† = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JF Authorised: Joanne Fry

Results: Tetrachlorobenzenes

Sample Identification: Composite 4

Laboratory Reference: 58715-4 Date Received: 20-Jul-09

Date Extracted: 31-Jul-09 Date Analysed: 31-Jul-09

Analyte	Conc.† (mg/kg)
1,2,3,5 + 1,2,4,5-tetrachlorobenzene	< 1
1,2,3,4-tetrachlorobenzene	< 1

† = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JF Authorised: Joanne Fry

Results: Tetrachlorobenzenes

Sample Identification: Composite 5

Laboratory Reference: 58715-5 Date Received: 20-Jul-09

Date Extracted: 31-Jul-09 Date Analysed: 31-Jul-09

Analyte	Conc.† (mg/kg)
1,2,3,5 + 1,2,4,5-tetrachlorobenzene	< 1
1,2,3,4-tetrachlorobenzene	< 1

† = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JF Authorised: Joanne Fry

Results: Tetrachlorobenzenes

Sample Identification: Composite 6

Laboratory Reference: 58715-6 Date Received: 20-Jul-09

Date Extracted: 31-Jul-09 Date Analysed: 31-Jul-09

Analyte	Conc.† (mg/kg)
1,2,3,5 + 1,2,4,5-tetrachlorobenzene	< 1
1,2,3,4-tetrachlorobenzene	< 1

† = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JF Authorised: Joanne Fry

Results: Tetrachlorobenzenes

Sample Identification: Composite 7

Laboratory Reference: 58715-7 Date Received: 20-Jul-09

Date Extracted: 31-Jul-09 Date Analysed: 31-Jul-09

Analyte	Conc.† (mg/kg)
1,2,3,5 + 1,2,4,5-tetrachlorobenzene	< 1
1,2,3,4-tetrachlorobenzene	< 1

† = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JF Authorised: Joanne Fry

Results: Tetrachlorobenzenes

Sample Identification: Composite 8

Laboratory Reference: 58715-8 Date Received: 20-Jul-09

Date Extracted: 31-Jul-09 Date Analysed: 31-Jul-09

Analyte	Conc.† (mg/kg)
1,2,3,5 + 1,2,4,5-tetrachlorobenzene	< 1
1,2,3,4-tetrachlorobenzene	< 1

† = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JF Authorised: Joanne Fry

Results: Tetrachlorobenzenes

Sample Identification: Composite 9

Laboratory Reference: 58715-9 Date Received: 20-Jul-09

Date Extracted: 31-Jul-09 Date Analysed: 31-Jul-09

Analyte	Conc.† (mg/kg)
1,2,3,5 + 1,2,4,5-tetrachlorobenzene	< 1
1,2,3,4-tetrachlorobenzene	< 1

† = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JF Authorised: Joanne Fry

Results: Tetrachlorobenzenes

Sample Identification: Composite 10

Laboratory Reference: 58715-10 Date Received: 20-Jul-09

Date Extracted: 31-Jul-09 Date Analysed: 31-Jul-09

Analyte	Conc.† (mg/kg)
1,2,3,5 + 1,2,4,5-tetrachlorobenzene	< 3
1,2,3,4-tetrachlorobenzene	< 1

† = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JF Authorised: Joanne Fry

Results: Tetrachlorobenzenes

Sample Identification: Composite 11

Laboratory Reference: 58715-11 Date Received: 20-Jul-09

Date Extracted: 31-Jul-09 Date Analysed: 31-Jul-09

Analyte	Conc.† (mg/kg)
1,2,3,5 + 1,2,4,5-tetrachlorobenzene	< 1
1,2,3,4-tetrachlorobenzene	< 1

† = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JF Authorised: Joanne Fry

Results: Tetrachlorobenzenes

Sample Identification: Composite 12

Laboratory Reference: 58715-12 Date Received: 20-Jul-09

Date Extracted: 31-Jul-09 Date Analysed: 31-Jul-09

Analyte	Conc.† (mg/kg)
1,2,3,5 + 1,2,4,5-tetrachlorobenzene	< 1
1,2,3,4-tetrachlorobenzene	< 1

† = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JF Authorised: Joanne Fry

Results: Tetrachlorobenzenes

Sample Identification: Composite 13

Laboratory Reference: 58715-13 Date Received: 20-Jul-09

Date Extracted: 31-Jul-09 Date Analysed: 31-Jul-09

Analyte	Conc.† (mg/kg)
1,2,3,5 + 1,2,4,5-tetrachlorobenzene	< 1
1,2,3,4-tetrachlorobenzene	< 1

† = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JF Authorised: Joanne Fry

Results: Tetrachlorobenzenes

Sample Identification: Composite 14

Laboratory Reference: 58715-14 Date Received: 20-Jul-09

Date Extracted: 31-Jul-09 Date Analysed: 31-Jul-09

Analyte	Conc.† (mg/kg)
1,2,3,5 + 1,2,4,5-tetrachlorobenzene	< 1
1,2,3,4-tetrachlorobenzene	< 1

† = Results are reported on a dry weight basis.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JF Authorised: Joanne Fry

Results: Tetrachlorobenzenes

Sample Identification: Laboratory Blank

Laboratory Reference: 58715 BLANK | Date Received: Not applicable

Date Extracted: 31-Jul-09 | Date Analysed: 31-Jul-09

Analyte	Conc.† (mg/kg)
1,2,3,5 + 1,2,4,5-tetrachlorobenzene	< 1
1,2,3,4-tetrachlorobenzene	< 1

† = Results are calculated using the average weight of samples in this batch.

< = Less than limit of detection.

Lab Analyst: VK Data Analyst: JF Authorised: Joanne Fry

Date 7 February 2023

Subject: **Towards Predator-Free Taranaki Project**

Approved by: D Harrison, Director - Operations

S J Ruru, Chief Executive

Document: 3138184

Purpose

1. The purpose of this memorandum is to present for Members' information a quarterly update on the progress of the *Taranaki Taku Tūranga Our Place - Towards Predator-Free Taranaki* project.
2. Officers will provide a presentation.

Executive summary

3. Launched in 2018, *Taranaki Taku Tūranga Our Place -Towards Predator-Free Taranaki* was the first large-scale project funded by Predator Free 2050 Limited with the long-term aim of progressing towards removing introduced predators from a region.
4. Three different phases of work are continuing around the mounga, working from north to south. This item reports on the three different elements to the project: urban trapping, rural control, and zero possums.
5. Monitoring work and site-led work is continuing and Council officers have had input into several technological innovations.
6. Roll out of the Rural programme continues, along with scheduled battery changes for the remote checking system and trap maintenance.
7. Within the Kaitake Zero possum project the A block area continues to be classed as possum-free for 19 months
8. Within the B block two individuals have been detected and removed this quarter.
9. The virtual barrier is functioning well within the Kaitake Zero project, with 16 possums caught in the reporting period, in line with catch trends seen in previous years.
10. The project has recently received a $2,500,000 funding boost through 'jobs for nature' funding allocated through Predator Free 2050 Ltd. This funding is targeted at extending the Zero possum area by up to an additional 5,800ha and will require 13 full time personnel over the next 18 months, these are a mix of internal staff and contractors.

Recommendations

That the Taranaki Regional Council:

a) receives this memorandum *Taranaki Taku Tūranga Our Place - Towards Predator-Free Taranaki project*

b) notes the progress and milestones achieved in respect of the urban, rural and zero density possum projects of the *Taranaki Taku Tūranga Our Place - Towards Predator-Free Taranaki* project.

c) notes that additional funding has been secured to extend the current Zero possum area by up to 5,800 hectares.

Background

11. On 30 May 2018, the Minister of Conservation launched the *Taranaki Taku Tūranga Our Place -Towards Predator-Free Taranaki* project.

12. The *Taranaki Taku Tūranga Our Place -Towards Predator-Free Taranaki* project is the first large-scale project with the long-term aim of progressing towards removing introduced predators from the region. Supported by more than $11 million from Predator Free 2050 Ltd (the company set up by the Government to help New Zealand achieve its predator-free 2050 goals), the Taranaki Regional Council (the Council) aims to restore the sound and movement of our wildlife, rejuvenate native plants in urban and rural Taranaki, and protect agriculture.

13. The project's ultimate aim is to support the eradication of mustelids, rats, and possums across the region by 2050. This ambitious goal had not been attempted before, and the first phases of the project have trialled control methodologies and new tools to inform future implementation, both regionally and nationally. The latest technologies – including remote sensors, wireless nodes and a trapping app are being used to remove predators and prevent re-infestations. This high-tech equipment makes trapping more efficient, particularly in rural areas, and sends an alert to the user when a trap goes off.

14. Project work is well underway around the mounga. There are three elements to the project:

    - Urban predator control
    - Rural landscape predator control
    - Zero density possums.

15. There has been a hugely positive response from communities wanting to restore our regional biodiversity by getting behind the *Taranaki Taku Tūranga Our Place -Towards Predator-Free Taranaki* Project as it continues to roll out across the region. Monitoring work and site-led work is well advanced and officers have had input into several technological innovations.

16. Set out below is an update of key progress and milestones in respect of the main elements of the project and details future work.

Urban predator control

17. Growth of the urban project has focused on South Taranaki with traps continuing to be distributed. Officers are working with South Taranaki District Council and keen local champions to increase trapping in the districts urban areas.

18. In New Plymouth, community trapping has been continuing in earnest. Within the Restore projects on TrapNZ, urban users have recorded an impressive 1,228 pest catches over the last quarter.
19. The Urban programme is now focusing on keeping traps active through ongoing engagement programmes including workshops and markets as well as working with schools to keep the children reminding parents to check the traps.
20. Community champions are continuing to support the programme and are a key tool in providing localised support to backyard trappers.
21. Ongoing support from New Plymouth District Council through management of the urban reserve trapping through volunteers and contractor actions.

Rural landscape predator control

22. No additional areas have been incorporated into the programme this quarter as staff focus on replacing batteries in wireless sensor nodes and maintaining traps laid in earlier phases.
23. Planning for phase 5 continued with roll out programmed to start in March.
24. Staff continue to encourage landowners to regularly check traps, rather than using council's regulatory tools, as farmers get used to incorporating trapping into their routines.

Zero-density possums

25. The Kaitake Zero possum project is continuing to progress well towards eradication in a number of its project block areas. Block A continues to be in an incursion detection and response phase, with only a two possum incursions detected in over 19 months. No possums were detected in the last quarter and we are confident in continuing to class the A block as a possum-free area.
26. The B block area has entered its incursion detection and response phase. Only two possums have been detected in the area in the last quarter with both individuals being removed.
27. The "individuals" phase of the project is continuing across the Kaitake range or C block area. Project partners Taranaki Mounga, have continued to utilising possum detection dogs and thermal imaging with very few detections. The lean trap network based on remote reporting leg-hold traps continues to remove individuals.
28. The trap barrier at Pukeiti is continuing to perform, sixteen possums were captured during the last quarter. While this number is higher than the previous quarter, this is largely due to dispersing individuals (mostly sub adult males).
29. In December Predator Free 2050 Limited agreed to fund an extension to the Zero Possum area south towards the Hangatahua / Stoney river.
30. The additional funding of $2,500,000 through the Governments Covid response "jobs for nature" programme will increase the area targeted for removal of possum by up to 5,800 hectare (see attached map) and employ 13 full time staff. Staff will be a mix of internal and specialist contractors.
31. The extended area will evaluate the use of dogs prior to baiting to accurately locate possums with the aim of reducing both labour and the use of toxins.

32. The programme will trial trapping and detection systems to both slow and detect possums moving back into cleared areas in a farmland environment. This is vital as New Zealand moves towards our predator free goal.

Decision-making considerations

33. Part 6 (Planning, decision-making and accountability) of the *Local Government Act 2002* has been considered and documented in the preparation of this agenda item. The recommendations made in this item comply with the decision-making obligations of the *Act*.

Financial considerations—LTP/Annual Plan

34. This memorandum and the associated recommendations are consistent with the Council's adopted Long-Term Plan and estimates. Any financial information included in this memorandum has been prepared in accordance with generally accepted accounting practice.

Policy considerations

35. This memorandum and the associated recommendations are consistent with the policy documents and positions adopted by this Council under various legislative frameworks including, but not restricted to, the *Local Government Act 2002*, the *Resource Management Act 1991* and the *Local Government Official Information and Meetings Act 1987*.

Iwi considerations

36. This memorandum and the associated recommendations are consistent with the Council's policy for the development of Māori capacity to contribute to decision-making processes (schedule 10 of the *Local Government Act 2002*) as outlined in the adopted long-term plan and/or annual plan.

37. All eight iwi provided letters of support for the funding of this project, Council are in regular contact with both Ngāti Tairi and Ngā Mahanga regarding the Zero-density possum operation within their rohe and iwi chairs are updated through the Taranaki Mounga Board.

Legal considerations

38. This memorandum and the associated recommendations comply with the appropriate statutory requirements imposed upon the Council.

Appendices/Attachments

Document 3138262: January 2023 Quarterly report to PF2050.

Document 3140569: Zero extension map

PREDATOR FREE 2050 Limited
LANDSCAPE PROJECTS

Quarterly reporting

Project Title: Towards Predator Free Taranaki

Report Author: Steve Ellis **Project period reported on:** October to December 2022

Highlights of overall progress

- Block A and B continue to be in an incursion detection and response phase, with only two possum incursions detected in this quarter; both of which were successfully destroyed within the B block. The virtual barrier at Pukeiti is continuing to perform well, with only routine battery and magnet sensor issues occurring during the reported period. These numbers are higher than in previous quarters as adolescent possums begin to move. The C block area is continuing to produce good results towards the new Zero definition. Detections are within a reducing area.

- Phase Five of the Rural Mustelid Control Project continued and support for the project within the community remains high. Support to landowners within the previous phases of roll out is continuing, as well as the training of biosecurity staff who will be undertaking ongoing project facilitation as part of the *Regional Pest Management Plan for Taranaki*.

- The community engagement team have continued to do an outstanding job working with community champions and schools to support additional voluntary possum trapping within backyards and reserves around New Plymouth and the wider Taranaki urban region. The team have attended the local AMP show and weekend market days.

- Sam Haultain resigned from her position of Programme lead she will finish in this role in January. We have managed to secure Nick Heslop who is very experienced in conservation management and pest control. Nick will start on 13 February.

Part 1 – Reporting against Progress Indicators, Milestones and Decision Points

1. Current Indicators, Milestones or decision point

Code	Description	Due date	Status	Comments
TRC TEG2	Possums eliminated from Zero area (A, B and C) (aligned with an adjustment to earlier decision point ZDDP3)	20-Oct-21	Not achieved – use **TRC TEG3** as new target	C block still maintaining low detections, B block incursions controlled and A block remains at zero.